THE TELEGRAPHIC JOURNAL AND

Electrical Review.

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THE ELECTRIC LIGHTING BILL.

THIS Bill, prepared and brought before Parliament by Messrs. Chamberlain and Ashley, was published in its original form in April last. It has recently, however, been the subject of an elaborate investigation by a Parliamentary Committee, and a number of eminent scientific men were examined at length as to their opinions on the matter. We have already published this evidence in a condensed form, but dealing sufficiently with the main points at issue. The Electric Lighting Bill, in its amended form, was issued last week, and we may now presume that its objects have been finally settled. The first clause, A, comprises *the Application of the Act, Granting of licences authorising the supply of electricity, Granting of provisional orders authorising the supply of electricity, and making of rules as to application, &c., under Act.* The part of Clause A relating to the *Granting of licences, &c.*, has been considerably extended beyond that of the original Bill, whilst the *Granting of provisional orders* has been revised to the extent of leaving out the following paragraph, which formerly appeared under this heading.

Where any company or person is authorised by provisional order to supply electricity within any area, any local authority within whose jurisdiction such area or any part thereof is situated may, within *six months* after the expiration of a period of *seven years* from the date of the passing of the Act confirming such provisional order, and within six months after the expiration of every subsequent period of seven years, by notice in writing require such company or person to sell, and thereupon such company or person shall sell to them their undertaking, or so much of the same as is within such jurisdiction, upon terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale), of all lands, buildings, works, materials, and plant of such company or person suitable to and used by them for the purposes of their undertaking within such jurisdiction, such value to be in case of difference determined by arbitration.

This requisition, which was evidently very unfair to electric light companies, and certainly calculated to retard the progress of the introduction of the new light, was commented on in our pages at the time, and we are glad to find that this most important matter has now a clause (N) to itself, and to the following effect :—

Where any undertakers are authorised by a provisional order or special Act to supply electricity within any area, any local authority within whose jurisdiction such area or any part thereof is situated may, within six months after the expiration of a period of fifteen years from the date of the passing of the Act confirming such provisional order, or of such special Act, and within six months after the expiration of every subsequent period of five years, by notice in writing require such undertakers to sell, and thereupon such undertakers shall sell to them their undertaking, or so much of the same as is within such jurisdiction, upon terms of paying the then value of all lands, buildings, works, materials, and plant of such undertakers suitable to and used by them for the purposes of their undertaking within such jurisdiction, such value to be in case of difference determined by arbitration: Provided that the value of such lands, buildings, works, materials, and plant shall be deemed to be their fair market value at the time of the purchase, due regard being had to the nature and then condition of such buildings, works, materials, and plant, and to the state of repair thereof, and the suitability of the same to the purposes of the undertaking, and where a part only of the undertaking is purchased, to any loss occasioned by severance; but without any addition in respect of compulsory purchase or of goodwill or of any profits which may or might have been or be made from the undertaking, or of any similar considerations. The Board of Trade may determine any other questions which may arise in relation to such purchase, and may fix the date from which such purchase is to take effect, and from and after the date so fixed, or such other date as may be agreed upon between the parties, all lands, buildings, works, materials, and plant so purchased as aforesaid shall vest in the local authority which has made the purchase, freed from any debts, mortgages, or similar obligations of such undertakers or attaching to the undertaking, and the powers of such undertakers in relation to the supply of electricity under this Act within such area or part thereof as aforesaid shall absolutely cease and determine, and shall vest in the local authority aforesaid.

This clause shows a great advance on the original paragraph to which we have just referred, and the electric light companies will probably rest content with this portion of the Bill. Although Dr. Siemens, Mr. Spottiswoode, Dr. Hopkinson, and others said in their evidence that a concession for twenty-one years should be the minimum, it is almost certain that arrangements could be made between the electric light companies and the local authorities, for the former to hold possession at least another five years over and above the fifteen granted by the terms of the Bill. This question of time is certainly a point demanding the most careful consideration when taking into account the heavy outlay which must necessarily be expended in arranging permanent works, and setting up permanent machinery to supply a large district such as those now illuminated by means of gas.

Up to the present gas has been held in reserve, so as to be at our service in case of the partial failure or extinction of the electric light; and in many instances it has taken the place of its more brilliant rival at a moment's notice, when, had it not been at hand, our streets, railway stations, and other places of importance would have been left in total darkness. When however certain districts are fairly given over for illumination by means of electricity, we shall no longer be able to rely on any assistance from gas, which has hitherto been of such service, and is now so much abused. In such cases it becomes imperative that the electric light shall be absolutely independent of any extraneous aid, and, judging from the Edison experiments on the Holborn Viaduct, this will not be found a very difficult matter to deal with. Still, it is a subject to bear in mind now that the gas companies will probably ask in some instances to be relieved from the obligation of supplying gas within certain areas. The clause (O) relieving gas undertakers from obligation to supply gas in certain cases runs as follows :—

Where a supply of electricity is authorised in any area by any licence, order, or special Act, and a supply of gas by any gas undertakers is also authorised within such area or any part thereof by any provisional order or special Act under the provisions of which such gas undertakers are under any general or limited obligation to supply gas upon demand, the Board of Trade may, upon the application of such gas undertakers, inquire into the circumstances of the case, and if they are satisfied that any specified part of such area is sufficiently supplied with electric light, and that the supply of gas in such specified part has ceased to be remunerative to the gas undertakers, and that it is just that such gas undertakers should be relieved from the obligation to supply gas upon demand as aforesaid, the Board of Trade may in their discretion make an order relieving the gas undertakers from such obligation, within such specified part of such area, either wholly or in part, and upon such terms and conditions as they may think proper; and from and after the date of such order, such gas undertakers shall be so relieved accordingly. All expenses of the Board of Trade in connection with any such inquiry or order shall be borne and paid by the gas undertakers upon whose application the inquiry or order was made.

There is a lengthy clause making "provision for protection of the Postmaster-General" and relating to telegraphic communication, but we do not see any mention of protection if the work of electric light companies should affect private telegraph and telephone lines. Surely some protection should also be made for these. We well remember, when listening a short time since to a performance of "La Mascotte" through the telephone, the interruption caused by the electric light currents of the Jablochkoff system being in close proximity to the telephone wires. At least we were told that this was the cause of the frequent and violent hissing, which destroyed much of the effect which would otherwise have been produced, and we have no reason to doubt that this was the true cause of the disturbance. Want of space compels us to leave over several other matters on which we should have wished to say a few words; but the ablest criticism of the Bill will emanate from the interested parties themselves, viz., the gas and electric light companies.

It is hardly to be expected that satisfaction will be expressed on all the points involved in these efforts for facilitating and regulating the supply of electricity, but it seems evident that there is nothing contained in the text which can be seized upon for any violently hostile attack; and we are feign to believe that the passing of this Bill will have a very beneficial effect upon the community at large. The arrangement of the clauses and the order in which they stand are as follows:—

1. Short title.
   Application of Act.
2. Granting of licences authorising the supply of electricity.
3. Granting of provisional orders authorising the supply of electricity.
4. Making of rules as to application, &c., under Act.
   Regulations to be inserted in licences, &c.
5. Expenses of local authority.
6. Power of local authority to borrow money.
   Accounts.
7. General powers of undertakers under licence or provisional order.
   Power for local authority to contract in certain cases and restrictions on assignments of powers, &c., of undertakers.
8. Incorporation of certain provisions of Clauses Consolidation Acts.
   Restriction on breaking up of private streets, railways, and tramways.
   Restriction as to above-ground works.
9. Power to undertakers to alter position of pipes and wires.
   Clause for protection of canals.
10. Compensation for damage.
    Undertakers not to prescribe special form of lamp or burner.
    Obligation on undertakers to supply electricity.
11. Charges for electricity.
    Recovery of charges, &c.
12. Injuring works with intent to cut off supply of electricity.
13. Stealing electricity.
    Power to enter lands or premises for ascertaining quantities of electricity consumed, or to remove fittings, &c.
    Electric lines, &c., not to be subject to distress in certain cases.
14. Provision for protection of the Postmaster-General.
    Purchase of undertaking by local authority.
15. Arbitration.
    Power for Board of Trade to relieve gas undertakers from obligations to supply gas in certain cases.
    Annual report by Board of Trade.
16. Definition of local authority, &c.
17. Interpretation.
    For the protection of mines.
18. Provision as to general Acts.
    Saving for privileges of Postmaster-General.

ELECTRIC LIGHTING BY INCANDESCENCE.

IV.

(*Continued from page* 300.)

WIRES or filaments of different diameters necessarily require different current strengths to heat them to the same degree of temperature; this is due partly to resistance, and partly to surface radiation. For the emission of heat which takes place from a surface varies directly as the latter, consequently in wires of similar lengths, the amount of the radiation must vary directly as the circumferences, that is, directly as the diameters of the wires. Since the quantities of heat which are emitted by wires must be exactly equal to the amounts which are generated in them, and since the quantities emitted or radiated vary directly as the diameters of the wires, it follows that the quantities of heat generated in these wires, when they are heated to the same temperature, must vary directly as their diameters. If then h_1 and h_2 are the amounts of heat generated, which are necessary to heat two wires, whose diameters are d_1 and d_2, to the same degree of temperature, then we must have:

$$\frac{h_1}{h_2} = \frac{d_1}{d_2}$$

Now, by Joule's law (Article III., p. 300), we have

$$\frac{h_1}{h_2} = \frac{c_1^2 r_1}{c_2^2 r_2}$$

where c_1 and c_2 are the current strengths heating the resistances, r_1 and r_2; but

$$\frac{r_1}{r_2} = \frac{d_2^2}{d_1^2}$$

therefore

$$\frac{h_1}{h_2} = \frac{c_1^2 d_2^2}{c_2^2 d_1^2}$$

or substituting the above value of $\frac{h_1}{h_2}$ we have

$$\frac{d_1}{d_2} = \frac{c_1^2 d_2^2}{c_2^2 d_1^2}$$

therefore

$$\frac{c_1^2}{c_2^2} = \frac{d_2^3}{d_1^3}$$

that is

$$\frac{c_1}{c_2} = \frac{\sqrt{d_2^3}}{\sqrt{d_1^3}} = \frac{d_2\sqrt{d_2}}{d_1\sqrt{d_1}}$$

thus, for example, the current strengths that would be required to heat to the same temperature two wires, whose diameters were 1 and 4 mils. respectively, would be in the proportion

$$c_1 : c_2 :: 1\sqrt{1} : 4\sqrt{4}$$

or

$$: : 1 : 8$$

Inasmuch as the amount of light given by an incandescent wire must vary directly as the surface, and as the amount of heat required to keep up a particular temperature varies also directly as the surface, it is evident that, on the score of economy, there is no apparent advantage gained by employing a thin wire or filament in preference to a thick one. For as regards surface, it is evident that we can have a definite superficial area giving off light, produced either by a long thin wire or by a short thick one; thus, for example, we could have a wire 1 inch long and 10 mils. in diameter, or one 2 inches long and 5 mils. in diameter; both of these wires could expose the same surface, though their resistances would, of course, be very different. If we call l_1 and l_2 the lengths of the two wires, and d_1 and d_2 their diameters, then in order that the surface they expose may be the same, we must have

$$l_1 d_1 = l_2 d_2 \text{ or } \frac{l_1}{l_2} = \frac{d_2}{d_1}$$

also, if we call r_1 and r_2 the resistances of the wires, we must have

$$\frac{r_1}{r_2} = \frac{l_1 d}{l_2 d_1^2}$$

hence

$$\frac{r_1}{r_2} = \frac{l^3}{l_2^3}$$

therefore, for the two wires in question the relative resistances will be

$$r_1 : r_2 :: 1^3 : 2^3$$

or

$$: : 1 : 8$$

THE CONTINUOUS CURRENT DYNAMO-ELECTRIC MACHINE, WITH INDUCTIVE SOLENOID, OF M. J. F. PLÜCKER.

SOME time since we inserted a short note relating to this machine, and we now extract a longer and illustrated description from our esteemed contemporary *L'Electricien*:—

The new machine of M. Plücker, Artillery Captain at Antwerp, which we show in the accompanying diagrams, was presented to the Royal Academy of Belgium, and formed the subject of a report by M. Maus and M. Ch. Montigny. This apparatus is a variety of the Gramme machine, the principal difference consists in the substitution of a solenoid for the electro-magnet, the branches of which embrace in the Gramme machine the cylindrical surface of the coil, to which is imparted a rapid rotatory motion. The solenoid is formed of an inductive wire wound horizontally along the two plane surfaces of the coil, above and below the axle, so as to form a fixed coil in which the movable one revolves."

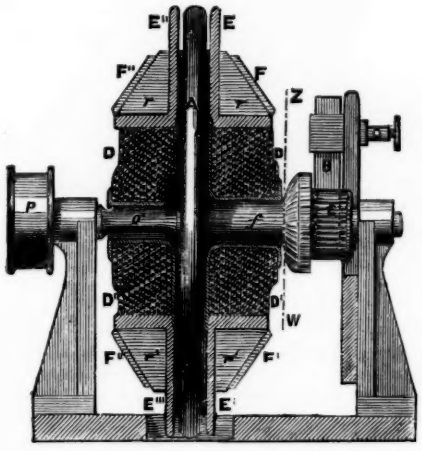


FIG. 1.
TRANSVERSE SECTION ON X. Y.

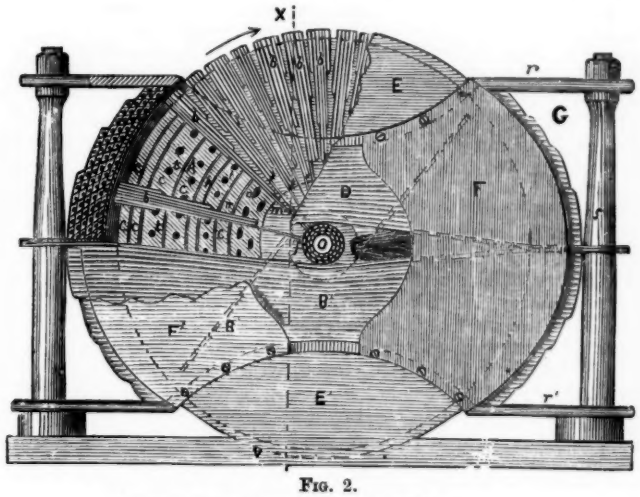


FIG. 2.
ELEVATION AND LONGITUDINAL SECTION ON Z. W.

We give herewith a description, by means of which our readers will be enabled, by referring to the diagrams, to grasp the details of construction. A, plate of iron with grooves and pierced with mortices, m, m, and with holes, t, t, which serve for the coiling of the bobbin, b, b. These coils are graduated in steps, so as to cover as completely as possible the surfaces of the plate; all the ends of the wires of the coils meet at the axle, o, of the machine, where they are joined together into a tubular cluster, f, so as to pass through the inductive solenoid, D, D', and then join the sectors of the commutator, C. On this commutator are arranged the two rubbers, B, B', which receive the induced current, and make it pass into the solenoid, D, D'. p, pulley fastened to the axle, o, and constructed to receive or transmit the rotatory motion. D, D', inductive solenoid, consisting of two flat coils of sheet brass, with flanges, r, r', of cast iron, a space being left between the two coils for the passage of the axle. These coils are supported by the pillars of iron, s s. The flanges, r, r', are arched so as to render the spirals of the inductive solenoid as nearly parallel as possible to the spirals of the induced coils. To these flanges are fixed four sheets of cast iron, E, E', E'', E''', placed on each side of the plate, A, and connected together by the pieces of sheet iron, F, F', F'', F''', which cover a great part of the inductor. These plates, E, E', E'', E''', become magnetised under the influence of the inductive current and the poles of the plate, A, and react upon the coils of the latter, concentrating the lines of force and thus reinforcing the action of the solenoid.

In order to make this machine work it is necessary to send a current into the coils of the inductor, the magnetism remaining in the plates, E, E', E'', E''', is then sufficient to start it.

In order to estimate the value of the solenoid as an inductor in comparison with the electro-magnet, the coils, D, D', were replaced by two horse-shoe electro-magnets, the poles of which were expanded in the form of sectors, each having a surface equal to a third of the plate, the arms of which were coiled with wire having the same section and the same total weight as that which constituted the solenoid. Under these conditions a current was obtained, the intensity of which was plainly equal to that of the current resulting from the employment of the coils, D, D' While producing the same effect the solenoid has the advantage of being lighter and less bulky than the electro-magnet.

Instead of a single inductive solenoid, several can be made to act on the same plate, by making them V-shaped. This arrangement seems preferable for plates of large diameter, and offers the practical advantage of a space in the centre for the passage of the axle and the wires to be connected to the commutator. As in the Gramme machines with several pairs of poles, as many pairs of rubbers as there are solenoids are required. In the first model constructed by M. Plücker, the plate bears 2·5 kilogrammes of double wire, 1 millimetre in diameter, forming 54 coils. The solenoid D, D', contains 8 kilogrammes of wire 2 millimetres in diameter. In subsequent experiments it was found to be advantageous to substitute for the plates, F, F', F'', F''', two horse-shoe electro-magnets connecting respectively the plates, E and E', E'' and E'''; the machine then becomes somewhat analogous to the Schuckert machine, in which the induction of the Gramme ring is produced along the lateral surfaces instead of on the outer cylinder. Exact measurements alone can show the practical value of these different arrangements, but the induced plate, in the form of a disc, seems to be easily coiled and applicable to the construction of small and inexpensive continuous motors.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.—Major Flood Page has resigned the post of manager of the Crystal Palace, and has accepted the office of general manager of the Edison Indian and Colonial Electric Company.

DUNAND'S SPEAKING-CONDENSERS AND MICRO-TELEPHONIC INSTALLATIONS.

SINCE the first experiments brought before the Academy of Sciences by M. Th. du Moncel, we have shown the readers of *La Nature* by what methods M. A. Dunand had succeeded in making condensers speak, which—if we except the experiments of M. C. Herz—were, up to that time, incapable of reproducing articulate speech. The result was of considerable scientific importance and showed once more the extreme delicacy of electrical action, as well as the exquisite sensibility of the hearing. We shall not now revert to these experiments, but we wish to show the practical results at which the inventor has arrived after long and interesting researches; these results are really remarkable and the experiments are very easy to repeat.

Let us first sum up briefly the arrangement of the whole system, which is clearly shown in fig. 1. At the transmitting station, a microphone, M, a battery, P, and the primary wire of a little coil, B, without condenser, are arranged in the same circuit; the secondary wire of the coil, B, communicates with the line and a battery, P′, of a few elements, the two free extremities are connected to the plates of a little condenser, C, which constitutes the receiver. By speaking before the microphone, the intensity of the inductive current is made to vary in undulations, and in the fine wire of the coil are developed induced currents which cause the charge of the condensers to vary; these undulatory charges and discharges of the condenser make it speak, but we cannot as yet fully explain the cause of the phenomenon.

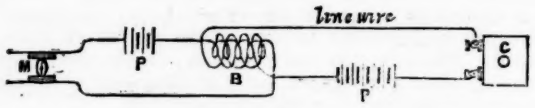


FIG. 1.

The presence of the battery, P, is indispensable in order that the condenser may articulate; the induced currents developed in the induced wire are added to or deducted from the current of the battery; the charge of the condenser varies in value, but always preserves the same direction. This has been, up to the present, the *sine quâ non* of the speaking condenser, and in all installations in which this condition has been observed, the condenser possesses this faculty in a greater or less degree.

Let us now come to the practical construction of the instruments. The microphone employed by M. Dunand, has a new form which seems to offer many advantages. It consists (fig. 2) of two metallic plates, A, A′, fixed in a wooden ring and forming a case hermetically closed, in which the microphonic system is completely sheltered from the air and from the dust which so frequently soils the contacts of ordinary microphones. Each of these plates has a little button of carbon, B, B′, fixed to its centre. Between these two buttons of carbon is a little oval-shaped piece of carbon, the length of which is somewhat greater than the distances between the inner surfaces of the buttons of carbon. This oval is held in the middle by a piece of brass wire stretched diametrically fixed at one of its extremities and connected by the other to a button, E. By twisting the wire more or less, the oval is pressed with more or less force against the two buttons and the microphone is rendered more or less sensitive. An index fixed to the button, E, moves on a graduated circle and enables the torsion of the wire to be easily regulated so as to adapt the sensibility of the apparatus to the nature of the sounds to be transmitted. The variations of resistance are produced by speaking before one of the plates; it is useless to dwell on this point which is so well known; two persons speaking, one before A, and the other before A′, can even transmit a duet which the receiving apparatus reproduces faithfully and clearly, without any regard to the often complete ignorance of the experimentalists.

FIG. 2.

The battery, P, is composed of four ordinary Leclanché elements, connected up two and two.

The coil, B, consists of a primary wire with about half an ohm of resistance, and the secondary has about 250 to 300 ohms.

The battery, P¹, which serves to charge the receiving condensers, consists of a variable number of Leclanché elements, according to the number of receiving condensers employed. When two condensers only are used, from six to eight elements are sufficient; with the fan-shaped receiver (fig. 3), consisting of twelve distinct condensers arranged in derivation, from twelve to fifteen elements are required. Speech can then be heard at a distance of more than a metre.

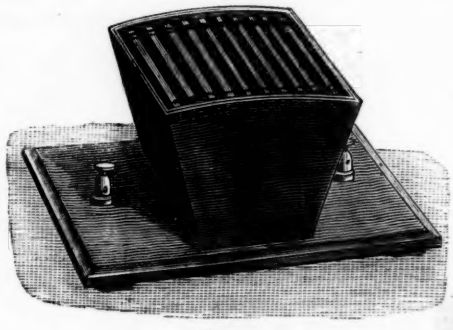


FIG. 3.

All condensers may serve as receivers, but they do not all produce equally good effects; those which have given the best results are not more than six centimetres in thickness. The simplest model consists of thirty to thirty-six sheets of tin-foil, separated by sheets of ordinary paper or paper coated with paraffin. A thin piece of wood or ebonite with a hole in the middle placed at each surface gives solidity to the system. One surface is sometimes furnished with a gutta-percha tube, which enables two persons to hear the apparatus at once, or one person to listen with both ears. In another arrangement M. Dunand uses two condensers in derivation fitted on a slight spring, which the listener places on his head. Although not very elegant this method is very convenient.

When it is required that the apparatus shall be heard by several persons at once, M. Dunand employs a receiver in the form of a fan (fig. 3) consisting of twelve little condensers placed in derivation in a box open at the top, the condensers being separated at the top by a space about equal to their thickness. Under these conditions with five Leclanché elements at P¹, the condenser can be heard, as we have already said, at a distance of more than a metre, and with thirty elements the voice is distinguisable within a radius of five or six metres.

The condenser employed as a telephonic receiver is characterised by the clearness and exactness of tone with which it reproduces the voice, which is not interfered with by the sound of the vibrating plate, as is the case with the ordinary telephone with a metallic plate.

M. A. Dunand has turned to account the practical advantages of his microphone in order to form a system of telephony

of very practical form. The apparatus, very cleverly constructed by M. Trouvé, is complete in itself; on a little board are fixed the microphone, the bell, the induction coil, a pair of receiving telephones, the press button, and eight terminals destined to receive the wires of the battery, the wires of the line, and the wires of the two telephones. The arrangement of a micro-telephonic installation is thus effected in a very short time and without a possibility of error. When the telephones are suspended to the levers, which are placed to support them when not working, the communications are established with the bell; on unhanging the telephones, the levers swing and automatically establish telephonic communications. When the conversation is finished, the communications with the bell are re-established by replacing the telephones.

The sounds produced by the ordinary telephone are much more powerful than those of the speaking condenser, but on the other hand the quality of sound is more metallic, more nasal, which is not, however, a great inconvenience in ordinary applications.

The results obtained by M. A. Dunand are very interesting, since already they enable the speaking condenser to be heard at a distance; there is every reason to hope that he will not stop there, and that we shall soon have further progress to record.—*La Nature.*

THE "METRE" BRIDGE FOR TESTING COILS ON DYNAMO-ELECTRIC MACHINES.

IN our last issue we mentioned an arrangement of the "metre" bridge which was used by us some years ago for testing the sections of wire coiled on the rings or armatures

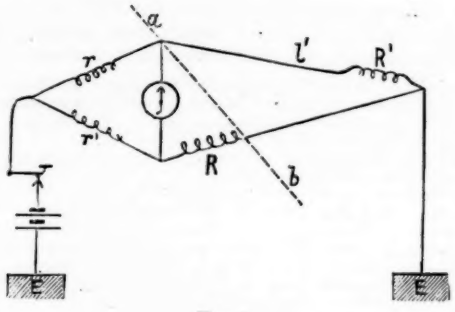


FIG. 1.

of dynamo-electric machines. Instead of measuring the actual resistance of each coil, we determined its precise length (the proper length and resistance required being known beforehand), and were therefore able to make a workman engaged in coiling the ring understand much more readily what was required, by speaking to him of feet and inches instead of fractions of ohms. As we believe this method would be much more serviceable now than in the past, when machines made were few and far between, we have thought it desirable to describe the system of measurement employed in detail, and to append diagrams of connections. It will be remembered that we spoke of the adjustable lengths of wire forming one side of the bridge as being in the testing room, whilst the sections to be measured were in an adjoining factory. Leading wires had, therefore, to be carried across from one room to the other, but these were eliminated by the following method devised by Mr. Robert Sabine, and which may be found in Clark and Sabine's "Tables and Formulæ." "The error due to the unknown temperature of the leading wires may be eliminated by the following contrivance. The apparatus to the left hand of the dotted line, *a*, *b* (fig. 1), is in the operating room, and that on the right-hand side is without. The leading wires, *l* and *l'*, are of the same metal, of the same dimensions, and of the same conductivity, and are spun-up close together in a suitable cable, so that at any given point they both have the same temperature and resistance. The junction of *l* and R' (the resistance to be measured) is to earth, that of *l'*, and R' is insulated; *r* is made equal to *r'*, therefore

$$R' + l' = R + l$$
$$R' = R$$

In the practical application of this system the instruments were arranged as shown in the accompanying sketch (fig. 2). A, B, is the "metre" of platinum or iridio-platinum wire attached to a scale divided into 1,000 parts. This forms, when divided at any point of its length by the contact-maker, C, the proportional parts of the bridge. Each side, however, may, if desirable, have prolongations by the insertion of equal resistances at *a* and *b*. From the end of the prolongation, *a*, a thick wire was led into the first of a series of mercury cups, M M. In these cups, and forming the adjustable resistance, or length of wire, as the case might be, were placed the amalgamated ends of a number of pieces of wire, R, R, of the same section and conductivity as that used for winding the rings of the dynamo-electric machines. As the sections of wire on the Gramme rings manufactured at the time we are now speaking of were about 30 feet long, the wires, R, R, were generally made up of the following lengths:—10, 10, 5, 2, 2, 1 feet, and 6, 3, 3 inches, or any parts of a foot that might be deemed advisable. A leading wire, *l*, from the other end of these mercury cups then passed from the testing over to the factory and was connected to one end of the section to be tested, the junction being connected by another wire through the galvanometer, G, back to the contact-maker, C. From the prolongation, *b*, of the other proportional arm of the bridge a second leading wire, *l'*, was connected with the remaining end of the section to be measured. These two wires, with that of the galvanometer, were wrapped up into a cable, outside of the line *c*, *d*, so that at any point the two leads have the same tem-

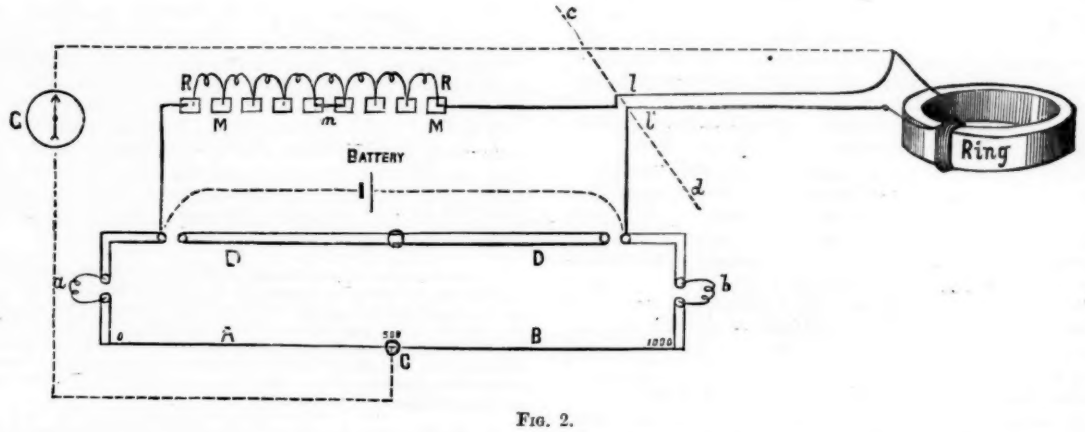


FIG. 2.

perature. Now, as they are both of the same length and resistance, and as they respectively form part of the adjustable resistance, and the resistance to be determined, they

may be ignored altogether, their elimination being complete under these conditions. It will be seen that it was not necessary to use that part of the apparatus shown at D, D. Any of the lengths of wire, R, R, could be short-circuited by inserting a thick copper strap into any two adjacent mercury cups, as can be seen at *m*. Of course a reversing key for both galvanometer and battery would be advantageous, although not absolutely necessary. The galvanometer is placed in the position usually occupied by the battery.

Testing by these means was found to be extremely convenient and rapid, and spared the use of the ordinary and more elaborate form of Wheatstone's bridge. Such an arrangement might easily be put into an ordinary workman's hands, as measurements in feet and inches would appeal to his understanding much more rapidly than 10ths or 100ths of ohms. There is, moreover, the advantage of having thick wires for the adjustable resistance, so that no heating of coils by the battery current can occur, and the still greater advantage when testing low resistances of having perfect contact between each coil or section of the adjustable side of the bridge. The apparatus could be advantageously employed in a portable form, and would obviously require less delicate manipulation than is usually necessary in making electrical measurements. It is also highly desirable when testing rings or bobbins containing large masses of iron to get the latter as far as possible away from the galvanometer, and this method offers a certain and ready means of testing from one room to another without it being necessary to give any consideration whatever to the leads. We have brought this matter before our readers' notice in the hope that in many instances it may be found of service to those interested in the manufacture and testing of dynamo-electric machines, and prove itself as useful in the present as it was found to be in the earlier days of electric lighting.

HISTORICAL DETAILS OF THE SUCCESSIVE IMPROVEMENTS MADE IN THE CONSTRUCTION OF THE TELEPHONE.

By LE COMTE TH. DU MONCEL.

WE find in the last number of the *Journal of the Society of Telegraph Engineers*, of London, a memoir by Mr. Dolbear, on the history of the telephone, in which may be found several statements which, we think, ought to be made known to our readers, and upon which we think it might be as well to express an opinion. According to Mr. Dolbear, the invention of the telephone should be accorded to Messrs. Page and Reiss. He gives credit for a certain part of the invention to Messrs. Farrar, of Keene, New Hampshire, who suggested the idea of reproducing sounds of different kinds by the vibrations of the armature of an electro-magnet, set in action by a suitable transmitter, but he dwelt more particularly upon the first two inventors. We have expressed our opinion with regard to the invention of Reiss in our article on the principle of carbon telephones, and we have also stated what amount of credit should be given to the researches of Page. Every one knows that the latter discovered the production of sounds by a bar of iron, under the influence of rapid magnetisations and demagnetisations. Nevertheless, it will not be uninteresting to give here Mr. Dolbear's remarks upon the subject.

In the system of Farrar, the exact date of which is uncertain, the armature set in vibration under the influence of an electro-magnet was fixed on a membrane stretched before an electro-magnet; and the transmitter was formed by harmonium reeds, which caused intermittence in the currents as in the tuning-fork of Helmholtz. His reeds were set in vibration by the action of finger-keys, and musical melodies could thus be reproduced. Mr. Dolbear adds, "that Farrar thought that he could transmit the human voice in the same way; but the numerous researches which he undertook in order to solve this problem not having been successful, and the most eminent authorities in America which he consulted having expressed the opinion that the idea was not feasible, the experiments were abandoned."

After these researches, says Mr. Dolbear, followed those of Helmholtz, who employed tuning-forks actuated by electro-magnets, in order to reproduce sounds at a distance. Finally Philippe Reiss commenced his attempts, which were at that date a great advance, but which seem to have been known but very imperfectly, for it appears certain that he endeavoured himself to solve the problem of the transmission of articulate speech.

Mr. Dolbear, taking this for granted, sought to show that one could easily discover the solution of the problem, for according to him it was known at that date (1860), that an electric current could cause magnetisation at a distance, that a sound of a definite value could be reproduced at a distance, that by speaking before a sheet of paper or a hat, the vibrations determined by the voice could be perceived by the hand; in fact, that the vibrations of a drum could be made to move a body arranged in such a manner as to cause a variation of contact; now the problem consisted in causing the vibrations of the human voice to react on an electric current, in such a way as to reproduce at a distance similar physical effects, and this could be done by the action of variable contacts determined by these vibrations in a current interrupter. It is then that Mr. Dolbear introduces in his memoir the phrases which we have referred to in our article of June 3rd, and which we have criticised, for it is certain in our opinion that the interrupter of Reiss has never produced undulatory currents, and it is for this reason that he did not succeed in transmitting speech in a proper manner. Besides, contrary to what Prof. Silvanus Thompson said in the ELECTRICAL REVIEW of May 27th, we think that the portion of the judgment which was delivered in England is perfectly clear as regards the Reiss receiver. It is certain that if the problem had been solved in 1860 there would not have been anything like the sensation which resulted from the discovery of the telephone by Bell, in 1876. Now, this is still more so, if one considers carefully the invention of Reiss, and that because it only admitted of the transmission of musical sounds.

Mr. Dolbear indicates, moreover, the different forms of the Reiss telephone, several of which were exhibited in the Exhibition of 1881, and this is what he says about it :—

Reiss adopted, at first, for his receiver the arrangement first devised by Page, which consisted of a bar of iron more or less long, surrounded by a helix and mounted on a resonant board. In this system the sounds produced resulted from variations in the length of the magnetic bar under the influence of variations of successive magnetisations determined by the transmitted current; and if these variations had been sufficiently great and sufficiently promptly repeated to produce sounds, this model would have given all the conditions necessary for the reproduction of articulate speech. There is no defect in this arrangement, but it is certain that Reiss only attained very feeble results, and for what reason? . . . . Because the electro-magnetic system was mounted on a board placed on a table, with the idea of obtaining in this way sounds as strong as possible, such as are obtained on the telegraphic instruments. Besides, even to-day any telephonic system can realise this effect under similar conditions; and in order that we may clearly distinguish speech, it is necessary that the apparatus be hermetically closed in a case and arranged in such a way that the sonorous waves of the air are brought and concentrated on the auditory nerve. Therefore the defect is not in the principle of the Reiss apparatus, but only in the general arrangement.

We are obliged to say to Mr. Dolbear that there exist telephonic receivers which are susceptible of being heard at a distance, and that the receiver founded on the principle of Reiss can only reproduce speech distinctly with very good microphonic transmitters, and arranged so as to furnish very decided undulatory currents. With the platinum contact transmitter of Reiss this is only possible when good Bell receivers are employed, and then the effects are only produced accidentally. Consequently we cannot say that Reiss solved the problem in this way. But let us continue what Mr. Dolbear says :—

It is curious that those who speak of the Reiss transmitter, and of his receiver, only consider generally the first of his inventions. He devised several others, one of which had an electro-magnet to produce the effects. In the place of employing the molecular movements of the bar for the production of sounds, he used the vibrating movements of an armature, and, with this arrangement, it was induction currents which caused the reaction. This form of apparatus of Reiss is the second which he arranged in 1863.

Mr. Dolbear then comes to the Bell telephone, which he seems to consider to be only a modification of the telephone of Reiss, based on the undulatory current principle, instead of being the result of differences of resistances in a circuit affected under the influence of vocal vibrations, caused by

the same movements of an armature before an electro-magnetic system. Induced currents result, a function of the amplitudes of the vibrations of this armature, which can determine the reproduction of speech in a receiver exactly similar to the transmitter. Mr. Dolbear admits, it is true, that this arrangement constitutes an improvement on that of Reiss, whilst it allows of the use of a battery and electro-magnet to be dispensed with; but he claims as his own idea the substitution of a permanent magnet in place of the electro-magnet employed by Bell in his first apparatus, an idea which he brought out in the year 1876. Those who have read our article on the history of the discovery of the telephone, inserted in the number of this journal for February 4th, will know to what this refers; for they will have remarked that on June 2nd, 1875 (*see* p. 98), Mr. Bell had thought of this substitution, and if this *savant* had not put this into practice in the apparatus exhibited by him at Philadelphia in June, 1876, it is because he expected to obtain more powerful effects by a system in which the magnetic organisation was formed by an electro-magnet (strongly magnetised by a continuous current), than by a system formed by a simple permanent magnet of steel. The judgment which was given in the United States last year makes this point perfectly clear. Mr. Dolbear, continuing his examination of the telephonic systems devised since that of Bell, expresses himself as follows:—

The instrument of Bell can only be employed on lines of from fifteen to twenty miles in length. It becomes necessary in order to work to a greater distance to find some other solution of the problem. The electro-magnetic system of Bell does not appear to be able to give better results than those at present obtained. The increase in the dimensions of the electro-magnet does not improve the working. An enlargement of the diaphragm can only be effected under limited conditions, and by making it thicker it becomes less sensible to the vibrations of the voice. Further researches have therefore been carried on on the first idea of Reiss, and many experiments have been carried out in order to perfect his transmitter or to replace it. Platinum has often been tried, but good effects have not resulted, and it was then that Edison proposed the employment of plumbago or of lampblack substances, which he formed into little cylinders, and on which he caused a diaphragm to act, vibrating in such a way as to vary a pressure in proportion to the vibrations produced, and capable of changing in like manner the resistance of the current. Later on it was shown that the substitution in the Reiss apparatus of retort carbon in the place of platinum made it one of the best transmitters that could be employed.

After having mentioned that a current of electricity could not only determine electro-magnetic, calorific, and physiological effects, but could also be caused to vary the amount of friction between two bodies, Mr. Dolbear spoke of the electromotograph and *motophone* of Edison, and of the system devised by him on a like principle, but depending upon electro-magnetic adhesion for its action. We have described this system (the *rotophone*) in the number of this journal for December 14th, 1881. He speaks there of telephones arranged by him, one of which was represented in fig. 5 of the article to which we have before alluded. This is what he says of it:—

This apparatus is an ordinary relay, the functions of which are simply altered by the connection with a telephonic apparatus, the vibrating plate of which carries a steel wire, which is very close to the nearest pole of the relay. Any changes which take place in the magnetism of this pole only affect a variation in the attractive effects produced in the wire, and the plate to which it is attached participates in these movements, acting, in fact, as the diaphragm of an ordinary Bell telephone.

Mr. Dolbear then describes his speaking condenser in the following manner:—

Every one who has charged a Leyden jar must have remarked that at the moment of discharge a peculiar crackling sound is produced. The first experiment in which this effect was observed in a condenser, other than of the Leyden jar form, was made in 1863, by Sir William Thomson, who used an air condenser connected to a submarine cable. He observed that each time the condenser was charged or discharged, a sound was produced which appeared to come from the air interposed between the different plates of the condenser. Some time afterwards, Dr. Wright, having connected two plates of metallic paper back to back, and insulated the one from the other, to the ends of the secondary one of an induction coil, found that he was able, with a Reiss transmitter placed in the primary current of the coil, to obtain, from the successive charges and discharges of the condenser, sounds of considerable power, sufficient indeed to be heard all over a large hall; but I have never heard that speech has been reproduced in this way. Subsequently, Mr. Varley employed condensers of a very large surface; but I am not aware that he ever attempted to obtain articulate speech in this way. Although in my actual apparatus I employ an air condenser, which works in exactly the same way, I was not led to its employment as a consequence of a similar train of thought. I thought that by passing an electric current of variable intensity through a substance which would be decomposed by the current, I should obtain the formation of gaseous components, which would occupy a greater volume than the substance in its natural state, and which would cause vibrations proportional to their quantity, and, consequently, proportional to the current strength.

I made several experiments, employing water as a decomposable substance, and I hoped that one of the plates being fixed and the other movable this last would vibrate under the influence of the gas resulting from the decomposition, this being produced with more or less rapidity according to the strength of the current. By fitting this plate with a telephonic mouthpiece, I ought, therefore, to hear sounds resulting from an intermittent current traversing the apparatus. This is in effect what took place, but in the course of one of my experiments, during which the water had escaped from the apparatus through a crack, I found that I could hear sounds without the presence of the liquid, and thus I arrived at my apparatus in this order of ideas.

Mr. Dolbear then described the condenser telephone, of which we have spoken in the number of this journal for December 14th, 1881. He explained its action, like Varley, as being due to the attractions exercised between the electrified bodies; but we no more believe in these attractions than in those produced in the Bell telephone, and the true explanation is that which can be deduced from the experiments of MM. Duter and Lippman, who show that the dielectric of a condenser becomes changed in volume under the influence of charges communicated to the plate. We will pass by this question, and leave Mr. Dolbear to give a complete account of his experiments.

What are, says he, the conditions for obtaining the maximum sonorous vibrations of a plate? . . . . . The most important is that it may move freely, and that its movements may have a certain amplitude without being constrained by contact with a rigid body which can hinder its central part from yielding to the waves determined by the physical actions caused in it. In an ordinary condenser formed of several plates, separately connected to the line, the electric tension would be the same all over, and would be limited by that of the plates which face the former ones; they would not, therefore, add to the effects produced on the extreme plates. If the dielectric has a large electrostatic capacity, an absorption is produced and interferes with the telephonic reactions, and if all the plates of the condenser, armatures, and insulated plates are strongly compressed, the one against the other, as in ordinary condensers, the vibrations will be stifled and reduced to their minimum effect. It is evident, therefore, that the plates must be separated from each other by a very thin layer of air, and it is by the non observance of this condition that many persons have not obtained good results from these kinds of apparatus when used as telephones. M. Herz has for some time experimented on telephones of this kind, and it is said that he has used as many as forty plates; but in my opinion the greater the number employed the less effective will be the telephone of this kind. The sonorous vibrations are produced with such rapidity by articulate speech, that one must avoid plates susceptible of absorbing electric charges under the influence of vibrations, and there is consequently a limit to the size of the plates and a choice to make in the dielectrics employed. I have experimented with plates of every size, from the thickness of a wire up to two or three feet superficial area, and although my apparatus is much smaller, I have found that the little plates were as good as the others from the point of view of power and of clearness of speech.

Mr. Dolbear then describes the electrical arrangement of his system. He shows that in these kinds of apparatus it is necessary that the electric current be of high tension. The discharges of glass plate electrical machines can be employed, but what are best are induction coils wound to a resistance of 2,500 to 3,000 ohms. "With such coils, a bichromate element, and a simple microphone transmitter, one can," says he, "make the receiver work on a circuit whose resistance is *almost unlimited*. One can even work several receivers at the same time." According to him it is not even necessary for one plate of the instrument to be put to earth, and it is possible to obtain reproduction of speech with a single plate, only the sounds are feebler; but it is necessary that there be in front of this plate a backing of caoutchouc which is susceptible of being induced by it. It appears, moreover, that sounds can be reproduced without there being any direct connection with the line wire.

Mr. Dolbear terminates his legal peroration as follows:—

I will now explain the advantages of my system, and will show why I claim it as a novelty.

The first system of Reiss was a system in which electricity was transformed into magnetism, and that by the vibratory movement of a plate. There is, therefore, in this fact a double transformation, whilst in mine the transformation is simple. The differences of potential are immediately tranformed into movements without anything intermediate, and I have, therefore, in consequence, the right to call it a novelty. The apparatus is reduced to its simplest form, and

I have been enabled to hear speech at a distance of 50 feet from the instrument, thus avoiding the inconvenience of having to place the apparatus to the ear.

In the electro-magnetic receivers where the electric current is employed, it is necessary to take into account the resistance of the current and arrange the helix according to Ohm's law, whilst in my apparatus there is no necessity for observing this condition. The price of the apparatus is very small, and does not exceed that of other systems, and the mode of operation is simpler. I have applied this system on lines as long as 256 miles, the distance between Boston and New York, and the wire employed was that of the *Rapid Telegraph* Company. I have repeated my experiments under the two different climatic conditions. The first time, the weather was wet and was preceded by two or three days of rain, so that the poles and insulators of the wire were as wet as possible, and there was a great loss in consequence of leakage. But this had no influence on the working of the instrument, and the sounds were not sensibly different from those obtained when the weather was dry. Long sentences could be heard without a single interruption, and no induction was noticeable, although this was sufficient to interfere with ordinary telephonic communications. One could perceive, it is true, the sounds produced by induction when the apparatus was inactive, but immediately that speaking commenced, no trouble was experienced. I have not experimented beyond the distance of which I have spoken, so that I cannot say more about it.

Thus terminates the communication of Mr. Dolbear, which has called forth several observations ; but I think it as well to remark that Mr. Dolbear, in calling his apparatus a novelty, is in error. In the first place, the production of sounds by a condenser was not new, inasmuch as Mr. Dolbear himself, in his historical account, alludes to it, and what would be new would be the possibility of reproducing speech in this way ; but it is M. Herz who obtained this result first, at the commencement of the year 1880. M. Dunand, of whom Mr. Dolbear was so careful to speak, in the month of September of the same year, obtained very important results in consequence of principles precisely contrary to those laid down by Mr. Dolbear. Thus, by means of eleven small condensers formed of sheets of paper of small dimensions and very numerous, joined up in quantity and arranged fan fashion, he succeeded in transmitting speech sufficiently powerfully to be heard at a distance of two to three metres from the instrument. It is true that he employed two batteries, one of which, that destined to polarise the plates, was very powerful ; but these experiments show that the theoretical ideas of Mr. Dolbear cannot be accepted without great reserve. I had, amongst others, shown that a great pressure exercised on the plates of a condenser did not prevent sounds from being produced.

It is certain that, if the experiments of Dolbear are exact, his apparatus would be more sensible than the others ; but it cannot be considered as perfect, and the diminution of the inductive action from neighbouring telephone lines which it effects, have been observed in the first experiments made in France.

We will not call attention to the observations which have been made at the Society of Telegraph Engineers of London, in consequence of the communication of Mr. Dolbear, for they teach the reader nothing ; but it is unpleasant for us to state that certain eminent men who belong to this Society have shown a complete ignorance of the host of distinguished *savants* who have occupied themselves in the question of the telephone. Is this forgetfulness real or voluntary on their part? . . . I do not myself know, but, certainly, to read the account given of this meeting, one is led to think it relates to a date when the question was for the first time brought before the public.—*La Lumière Electrique.*

EDISON'S ELECTRIC RAILWAY.

THE bed of Edison's Electric Railway at Menlo Park is as yet unballasted, so that a ride over its two miles of length is productive of unpleasant jerks and bumps. From the building next to the workshop at Menlo Park, where the steam engine and dynamo-electric machines are placed, a narrow plank walk leads across the field toward the woods in the rear. In this are the wires running from the dynamo-electric machines to the railway track, distant perhaps a quarter of a mile. Here the wires are noticeable, emerging from their casing and communicating with the rails. At first sight the track appears to differ from an ordinary railroad only in its gauge, which is three feet six inches. But a closer examination reveals three distinctive features. Where two rails meet they are joined together on the sides. On each side of the joint is a strip of copper, the ends of which are nickel-plated. Outside these strips are screwed on flat bars of iron, the inner surface being also nickel-plated. Thus the current of electricity passes uninterruptedly from rail to rail. As this cannot be done at the switches, however, thin plates of copper are placed underneath the ends of both rails, so that the circuit is not broken. The frog in the switches is left out of circuit. It is only about three feet long, and as the driving-wheel of the engine is 4½ feet in diameter the wheel passes over the frog with no perceptible interruption. Near the improvised engine house, which stands a short distance above the point where the wires connect with the rails, and about a quarter of a mile from that end of the track, the one passenger car of the railway stood. The engine was running up and down the track, conveying Charles T. Hughes, the superintendent, and dragging a small platform car loaded with rails and ties. In appearance the engine is peculiar. If an ordinary engine was cut in two midway of the boiler, the forward half discarded, and the cab reduced in size, it would present a tolerably correct representation of the electric engine. Its length is 15 feet, and the height to the top of the cab nine feet. Of course there is no smoke-stack.

When a reporter took a seat in the cab the flat car had been left at the lower end of the track. Mr. Hughes raised the lever of the armature switch and the engine started. The engine ran evenly at the rate of eighteen miles an hour. No arrangement had been made for running at high speed, as Mr. Hughes was using the engine simply in construction work, and it had been dragging loads of three or four tons. The four dynamo-electric machines at the central station were arranged in a multiple arc instead of in series, as is done to attain a higher speed. Two miles of the road have been completed, extending toward Plainfield, and a mile remains to be finished. At the lower end men were engaged in ballasting the track. The road runs from the engine-house over a trestle about twelve feet high, through a swamp, and then through some fields, where there are cuts. Thus far the engine has done all that was expected. Yesterday and on several previous occasions it has proved itself equal to the task of drawing loads as heavy as could be applied, considering the character of the road and rolling stock. On Wednesday, with the dynamo-electric machines arranged in series, it ran at the rate of 41 miles and 4,000 feet in an hour, the highest rate that has as yet been reached. The rate of speed is estimated by the number of revolutions of the armature in the engine. The engine can be readily started, reversed, and stopped. In the cab, where the steam gauge is placed in the ordinary engine, is the armature switch. Raising the lever sends the current into the armature of the dynamo-electric machine in the front of the engine. If the lever is horizontal the circuit is broken, and if the lever is pulled down the current is directed into the armature in such a way as to cause it to revolve in the opposite direction, and the engine consequently moves backward. Mr. Edison intends to use an electric brake, but at present in order to stop, the circuit is broken and an ordinary brake applied.

In examining the engine more closely, the reporter found two sheet-iron doors in the sides of what appeared to be the boiler, so that an inspection of the interior was easy. In front is a dynamo-electric machine ; running lengthwise are the two legs of a large magnet, and the remainder of the interior is occupied with shafts and belting. An interesting feature is the course of the current and its transformation into motive power. It is taken up from the rails by the rims of the driving-wheels, and passes through copper clamps to the hub. Rubbing against the hub is a copper brush at the end of a horizontal rod, which has the position of the connecting-rod of an ordinary engine. The current taken from the hubs of the driving-wheels by these brushes passes along the rods to wires which lead to the armature switch in the cab. From this switch the two wires are conducted to the armature of the dynamo-electric machine in front. This machine may be said to fulfil a double function—in absorbing and storing up electric energy as well as in developing it. When the armature and bobbins revolve the power is transmitted by belting around a pulley on the same shaft with the armature to a pulley on a shaft under the cab. Thence belting runs to a pulley on the shaft of

the driving wheel. From the armature wires two smaller wires run to the coils of the magnet placed horizontally in the engine. These are the field wires, and through them the magnet becomes charged with electricity, and exerts a controlling influence on the armature which receives the greater force of the current. Without this magnet the armature would receive the full power of the current and would become so heated as to be useless; but the electricity in the magnet, which can be increased or diminished at will, tends to draw the armature toward it, and in reality causes it to revolve.

The total weight of the engine is four tons. The road, three miles long, will soon be completed and ballasted. One central station for every ten miles of track is Mr. Edison's estimate, the current being sent through the rails for five miles on each side of the station. After elaborate calculations in the case of the electric motor as compared with the steam locomotive engine, Mr. Edison claims that the ratio of mean economy for both is 4 to 8·93, or 55⅔ per cent. in favour of the electric engine.—*New York Tribune.*

EXPERIMENTS IN UNDERGROUND TELEPHONY.

[As an instance of the progress of experimental telephony in America, we extract the following particulars from the *Scientific American Supplement.*]

AN underground cable has recently been laid along the Boston and Providence Railroad by the American Bell Telephone Company, for the purpose of ascertaining, by actual experiment, what may and what may not be done in telephony upon underground wires. The fact that the American Bell Company has gone to so much expense in connection with such experiments shows that it is in earnest, and, that if underground work shall prove practicable, it will not be neglected.

The cable was made by Eugene F. Phillips, of Providence, R. I., and consists of twenty-one rubber covered copper wires in an external protecting pipe of lead. Ten of these conducting wires, after being insulated with rubber, are covered with tin foil, which is intended to act as a conducting surface to carry off extraneous induction currents. Ten more, after being covered with rubber, are twisted together, and are intended to be operated as metallic circuits. This plan is also regarded as a protection against induction.

The twenty-first wire is an ordinary No. 13 office wire, covered with cotton and paraffined. The cable when completed weighed 30 tons, and filled three freight cars. It was laid on Sunday, April 16th, between the two tracks of the Boston and Providence Railroad, the south end being at Attleboro, Mass., and the north end at West Mansfield.

The entire length of the cable was about a hundred feet over five miles. It was divided into sections of 530 feet in length, each section coiled on a separate reel.

A trench varying from eight to twelve inches in depth was made, in which the cable was buried, the two ends of each adjoining section being connected by screw connections in test boxes, placed at the required positions.

Not the least interesting feature in the operation was the method adopted of excavating the trench. A box car attached to a locomotive was provided, which was made open at the rear end and carried the necessary tools. A beam of wood was lashed to the rear of the car. To this a plough was chained, a man took hold of the handles, and the locomotive was started, the plough cutting the trench at the rate of three miles an hour.

The cable was then laid in a similar way from the reels, which alternately were placed at the rear of the car, and when the last length was deposited in its earthly bed, the same inventive talent which had devised the locomotive plough drawer devised also a method for filling up the trench. A heavy plank was trailed from the car at such an angle that when the train moved ahead the earth and gravel were scraped back into the trench and the cable properly covered. Several lengths of the cable being uncompleted, the work could not be finished until the following Sunday, April 23.

Roadmaster E. M. Merrill, of the Boston and Providence Railroad; Messrs. Phillips and Sawyer, the manufacturers, and Mr. H. B. Lyttle, the manager of the Boston Telephone Despatch Company, were present, the latter gentleman having had the entire charge of the mechanical details of laying the cable. The upper room at Attleboro station is to be the testing room, and it is expected that valuable knowledge will be gained by the proposed experiments, which will be conducted by the electricians of the American Bell Telephone Company.

It is interesting to note in this connection that while those engaged in this enterprise were totally unaware that the use of a plough propelled by a locomotive had ever been previously suggested for the purpose of making a cable trench, such an arrangement was patented in 1850 in England by Dr. Werner Siemens, who claims separately both plough and locomotive. There is certainly nothing new under the sun.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.—JUNE 17th.

THE Physical Society met in Oxford by invitation of the President, and after luncheon in the Hall of Merton College, by kind permission of the Warden and Fellows, the health of the society was proposed by the President, and responded to by Lord Rayleigh. The usual meeting was then held in the Clarendon Laboratory, Prof. CLIFTON, President, in the chair. Dr. W. H. STONE exhibited and described an electro-dynamometer, specially designed for measuring the currents used in the medical applications of electricity. For this purpose a light suspended coil is an advantage, and Dr. Stone adopted aluminium, which, with equal conductivity to copper, weight for weight, is very much lighter than copper. No frame was used for the coil, which was tied up with silk and varnished, amber varnish, such as used by photographers, being recommended by the author for this and similar purposes as preferable to shellac. A bifilar suspension of the coil was adopted to give directive force to the coil, the threads being of silver-gilt wire drawn after gilding, and such as is used in making gold lace. It is preferable to platinum wire by reason of its lower resistance. Silver-gilt wire 1-500th of an inch in diameter has a resistance of 9·8 ohms per metre; whereas platinum of same dimensions measures 62·2 ohms. Aluminium wire can be drawn as fine as copper. Some difficulty has hitherto been experienced in making contacts with it for electrical purposes, but Dr. Stone believes he has overcome these. The gilt wire makes a good contact with it. The specific heat of aluminium is high, and hence it is recommended by the author for resistance coils. The threads of the suspension were hung from two little brass springs, placed horizontally in line and capable of being adjusted to and fro so as to widen the distance between the points of suspension when necessary.

Mr. VARLEY, Prof. PERRY, and others, offered some remarks.

Mr. BOSANQUET then described his application of the Faure accumulator, charged by a dynamo-electric generator to the working of laboratory apparatus, instead of the usual Grove or other battery. The net result of his experiments is that the accumulators charged for two hours have sufficient energy to keep the apparatus employed running for a week, and hence it is unnecessary for him, as heretofore, to put up thirty Grove cells each day.

Prof. PERRY observed that a well-made Faure cell, having the minium laid on in a uniform coat, does not lose its charge nor develop local action, as is done by those accumulators in which the minium is put into holes in the plates.

Prof. W. G. ADAMS then took the chair,

While Prof. CLIFTON described some ingenious devices adopted by him in lecture experiments on electrostatics. These consisted of insulating glass stems, with glass cups to hold sulphuric acid formed on the stems; also a form of key, which by rapidly succeeding contacts brings the spot of light on the electrometer scale to rest without tedious swinging. He also described a form of lecture galvanometer, sine or tangent, which could be readily shown in all its working to a large class, and exhibited a simple and inexpensive apparatus for measuring the focal length of a lens in six different ways, according to what is known about the lens. The results showed that the apparatus was very accurate in its indications.

THE "MARKLAND" ELECTRIC LIGHTING, POWER AND "REGULATOR" COMPANY (LIMITED).

QUITE recently a company was promoted for the purchase of the "Standard" (Fyfe-Main) arc lamp. The price required by the vendors of this invention was, we think, utterly out of all proportion to the present value of arc lamps, and although a dynamo machine was said to be included in the arrangements, this could hardly be taken into account at all, considering that a provisional protection had only just then been applied for; therefore the Fyfe-Main Company may fairly be said to have been promoted on the basis of the lamp alone.

We are not quite certain that the invitation to the public for subscriptions answered the expectations of the promoters, but as we do not intend going into this question now it matters little.

The Fyfe-Main lamp certainly acted uncommonly well during its brief stay at the Crystal Palace Electrical Exhibition, and to some extent therefore the glowing terms in which its merits were announced were pardonable. At any rate the investing public could see for themselves what they were putting money into. It also had the advantage of being reported upon favourably by eminent professors of electrical science, which, however, does not perhaps go for much outside certain circles. We notice that a new company, the "Markland," is apparently being floated on the strength of a similar invention to that above referred to; but under less favourable circumstances, as the public here has had no opportunity of judging its capabilities. According to the prospectus—

This company has acquired the right to purchase the English patent, No. 3,679, of "The Markland Lamp and Electric Light Regulator," which invention relates to the use and adaptation of the regulator to that class of electric lamps which employs as a means of producing light, the voltaic arc, and by governing or regulating the movements of the electrodes, secures a steady uniformity of combustion unequalled by any other method extant.

By the adaptation of this regulator to existing lamps, a considerable portion of the lamps (*i.e.*, the most delicate and costly portion of electric lighting) can be dispensed with.

The consequent superiority of this invention will commend the "Markland" and all other electric lamps to which "The Patent Regulator" is applied, as being, *par excellence*, the lamps of the future.

The practical success of the invention has been thoroughly demonstated in the United States, where a large and influential company has been formed to work it, and is now in active operation.

The following points are especially claimed for the lamps to which the Patent Regulator is affixed.

1. The light is rendered so clear and steady that all shades of colour may be accurately compared without in any way distressing the eyesight.
2. It stands unrivalled in its clear, perfect, and unchanging steadiness.
3. The construction of the Regulator is simple, inexpensive, and not likely to get out of order.

There are annexed to these paragraphs the reports of three professors as they are termed in the prospectus from which we are quoting. Their names are J. Albert Barrett, acting electrician to the British Museum; J. A. Graham, electric and chemical engineer, and H. W. Hammond, A.M.I.C.E., &c. What value may be attached to their opinions we cannot divine, but a few extracts may be of interest to those who hitherto have only seen that part of the prospectus which appears in the daily papers. Mr. Graham says :—

I have carefully examined your patent of Electric Light Regulator, No. 3679, 1881, which, though simple in construction, fully provides for all the necessary movements which are indispensable to a good arc lamp. . . . .

Your lamp, fitted with the Regulator, will enable those unskilled in electrics to employ this means of artificial lighting with ease and efficiency. When once the lamp has been properly adjusted any ordinary person may be intrusted to recharge the electrodes by simply dropping the carbons into their respective positions. No further adjustment will be required. . . . .

A lamp constructed on this principle may be kept in action for a considerable period, as it is possible to so arrange the electrodes that fresh carbons may be introduced during the action of the current, without danger, and with little or no interruption of the light.

Its adaptability to existing lamps is a most important point and will prove a valuable addition to the company's revenue, as it may be advantageously adopted by all other systems, and therefore should produce a large return from royalties. . . . .

Its cost, comparing most favourably with existing systems, must, when generally known, place it in the front rank.

I am therefore of opinion that this Regulator will do excellent service and give satisfaction wherever it is properly applied.

We believe that the Brush, Siemens, Pilsen, and other lamps which we could mention have given satisfaction when *properly applied*, but doubtless they will jump at the idea of adapting this regulator or lamp for their own purposes; still we hope that these companies will not recklessly take advantage of such facilities until they have carefully studied the claims of this patent. Mr. Barrett states as follows :—

I have had great satisfaction in carefully perusing your patent No. 3679 of the "Markland Lamp," or "Regulator for Arc Lamps." For a long time past I have felt that a great want has existed of a lamp which could entirely dispense with mechanism of every description. It appears to me that this very important point is more perfectly attained in the "Markland Lamp" or "Regulator" than in any other lamp which I have seen as yet.

In your lamp the action of the *clutch* is entirely controlled by the current; and in the same way as the core is acted upon in the coils of many lamps now in general use where it is assisted in its operation of releasing the electrode by either clock-work or some other counterbalancing influence, in the "Markland Lamp," the clutch, the action of which is identical with the vertical movement of the core in the coil, does the duty of the clock-work, or other influence now in use, the electrode being kept in its true position by the self-acting rollers above the coils.

As far as I can see there are no vital portions of the lamp likely to get out of order, and therefore no skilled person is required to attend to the regulation—the arc once set, the current producing the light will by the arrangement of the clutch regulate the feed of the lamp simultaneously, making this practically "the desideratum in arc lamps."

We think we have a dim recollection of Mr. Barrett's connection with a system of electric lighting shown in Oxford Street some time since. We there saw a small Gramme machine working a lamp something after the type of the *Lampe Soleil*, and also occasionally an arc lamp of the more usual form (Harrison's, we believe). Forming part of this system was a revolving commutator for switching very rapidly the current from the machine on to a number of lamps radiating from the commutator in different directions. The idea was to make-and-break the connections from one lamp to another in such rapid succession that the blinks or extinctions would not be noticeable to the eye, and it was therefore said that the same machine which produced the current for the one lamp would just as well operate on as many as one hundred. We need scarcely say that we were not witnesses to any experiments with the revolving commutator, this portion of the whole system being demonstrated verbally. With the British Museum experience, however, Mr. Barrett has undoubtedly a right to speak authoritatively on the subject of electric lighting. We ourselves have seen the "Markland" regulator—not in action, however—and its construction is certainly simple; and we have no reason to doubt that it would act as well as any other arc lamp of the clutch type. The lamp effects the following objects, but we fail to see any novelty in the operations here performed :—

1st. To separate the points of the carbon electrodes to a proper distance from each other for the production of the electric arc when the electric current is established.

2nd. To feed forward one of the carbon pencils at a rate sufficient to compensate the waste or destruction of the same which takes place so long as the current is passing.

3rd. When the current from any cause is interrupted or ceases to traverse the lamp, to instantaneously bring the carbon electrodes into contact with each other.

It is also stated that—

By means of this electric light regulator a number of lights may be exhibited in series in the same electric circuit, as the regulation of each light depends upon the resistance offered by its own arc, and is wholly independent of the action of other lamps included in the same electric circuit.

This we again confess our inability to understand, as up to the present we had been under the impression that when one or two of a number of lamps, connected up in series, went amiss, the remainder of the lamps in circuit were also disturbed for reasons too well known to make any comment upon.

The vendor of this invention, who is also the promoter of the company, requires for its purchase £24,000 in cash, 66,000 fully-paid A shares of £1 each, and 100 fully-paid B shares of £1 each.

This £90,100 is an extremely moderate price to be paid out of a capital of £200,000, for however good the lamp may be, and its simplicity is undeniable, there are others in our opinion now in use equally efficient, and which *might be* made and sold as cheaply as the "Markland" Company purposes doing.

In regard to this part of the question, the following correspondence has taken place in the daily press :—

101 and 102, St. Martin's Lane, W.C., June 19.

SIR,—Our attention has been called to the statements in the prospectus of the Markland Electric Lighting, Power, and Regulator Company, advertised in *The Times* of Saturday, in which we are stated to have corroborated the opinion of certain gentlemen mentioned in the prospectus as to the superiority in point of efficiency and economy of the Markland light.

We beg to inform you that we have not tested this lamp in any way, and have, consequently, pronounced no opinion whatever as to its efficiency or economy.

We were simply asked some short time since to give an estimate of the price at which we should be willing to manufacture the lamps in question, but whether that price enables the company to supply the lamps as stated in the prospectus at a price 75 per cent. lower than that charged for the lamps referred to we are unable to say. As the statements in the prospectus are likely to mislead the public and also to injure us in our business as manufacturers to other electric light companies, may we ask the favour of your publishing this disclaimer?

We are, Sir, your obedient servants,
ELLIOTT BROTHERS.

The Markland Electric Lighting, Power, and Regulator Company (Limited), 8, Tokenhouse Yard, London, E.C., June 20.

SIR,—Referring to the letter of Messrs. Elliott Brothers appearing in *The Times* of this morning, the directors will be obliged by your inserting the following copy of Messrs. Elliott Brothers' estimate :—

101 and 102, St. Martin's Lane, May 22.

Messrs. Manson, Woods, and Carter, 36, King William Street, E.C.

GENTLEMEN,—In answer to your inquiries as to the price of the electric lamp left here by Mr. Berry this morning, we beg to inform you that the price for the first 100 lamps would be about £5 5s. (five guineas) each. We have no doubt they could be made afterwards for much less.

We are, gentlemen, yours faithfully,
ELLIOTT BROTHERS.

After adding 60 per cent. to this amount for profit, a result is arrived at of £8 8s. as the selling price of this company's lamp, being 75 per cent. less than £33 6s., the published selling price of the company's lamp referred to in the prospectus.

Thus is the economy of the lamp clearly established by the estimate of Messrs. Elliott themselves.

As to the other point in Messrs. Elliott's letter, the directors considered themselves justified in making the statements used in the prospectus from the report of the interview which took place between Mr. Carter, Mr. Berry, and the representative of Messrs. Elliott Brothers, on May 22, 1882, when the lamp was submitted for their examination, prior to their sending in their estimate.

I am, Sir, your obedient servant,
HENRY KENDRICK, Secretary.

Such proceedings as these will not enhance the chances of success which this company may possess in being the fortunate owners of a good arc lamp, and we think the directors acted most unwisely in taking advantage of a private conversation. The less public controversy on such matters the more likely will it be that the projects in view will arrive at a satisfactory conclusion.

A thing well begun is already half done, but it seems to us that the "Markland" vendor wishes to accomplish more than this with one stroke of his financial genius.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

THE HISTORY OF SUBMARINE CABLES.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—The ELECTRICAL REVIEW of June 17th, containing a paper by Mr. R. S. Newall upon the early history of submarine cables, has only reached my hands at a time when it is out of my power to devote any time whatever to correcting a few errors into which Mr. Newall has, no doubt inadvertently, fallen. If you would permit me, I will address you a few remarks in time for your issue of July 1st.

Yours, &c.,
CHARLTON WOLLASTON.

Biaddonfield, Torquay, *June 20th*, 1882.

[We are pleased to insert Mr. Wollaston's letter on this subject, and shall look forward to the communication he promises, which will doubtless be of great interest to all connected with the early days of submarine cables.—EDS. ELEC. REV.]

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—The attention of the Telegraph Construction and Maintenance Company has been called to the publication in your issue of the 17th inst., of some statements by Mr. R. S. Newall, headed, "Facts and Observations Relating to the Invention of the Submarine Cable," &c., and we are instructed, as solicitors to the company, to write to you on the subject.

It does not concern our clients to discuss Mr. Newall's claims as set forth in this paper, except with respect to the following paragraph :—

My invention of the mode of coiling cables in circular tanks, with a central cone and rings, has been extensively pirated by Messrs. Glass & Elliot, who after losing the first cable they contracted to lay, used my apparatus in laying every cable they afterwards made, and against whom I obtained repeated verdicts for infringing my patents. They were followed by the Telegraph Construction Company, Mr. John Pender, chairman, against whom I also obtained verdicts.

We distinctly deny that Mr. Newall ever obtained a verdict against the Telegraph Construction and Maintenance Company.

He commenced a suit in Chancery against them in 1865, which lingered on for some years, Mr. Newall never filing a sufficient answer to the company's interrogatories, and at last in 1871 he definitely abandoned the suit, and himself obtained an order putting an end to it.

In 1869 Mr. Newall commenced a separate action in the Court of Common Pleas against the company, but after inspection of the *Great Eastern* ss. by the plaintiff the action was dropped and nothing further done.

We are informed that with respect to Messrs. Glass & Elliot the litigation with them resulted not in Mr. Newall's obtaining "repeated verdicts for infringing my patents," but in Mr. Newall's agreeing to pay £1,000 for Messrs. Glass & Elliot's costs. A letter dated June 6th, 1881, from Mr. Newall's solicitors is before us, in which it is promised that the amount shall be paid in a few days.

It is surprising that Mr. Newall's memory can have so seriously misled him as to some at least of the "facts and observations" with which he has favoured you.

We have to request you to be good enough to insert this letter in your next issue,

And remain,
Your obedient servants,
BIRCHAM & CO.

26, Austin Friars, *June* 22, 1882.

THE CANDLE-POWER OF ELECTRIC LAMPS.

To the Editors of THE ELECTRICAL REVIEW.

DEAR SIRS,—Being much interested in the question of Electric Lighting (although not in any sense of the word an electrician), and a constant reader of your valuable journal, I have been much perplexed by the correspondence and apparent difference in opinion of the *savants* as to the illuminating power of the various lamps; while some declare that a certain lamp gives 2,000 candle-power, others maintain that it does not give more than 700.

Technical terms no doubt are useful when employed to and by those between whom there is a mutual understanding as to their precise meaning, but when used to those not so initiated, they are often stumbling-blocks and misleading. Now, if the term "candle-power," as above employed, means that the light so given is in brilliancy, amount, useful results, and in all other respects exactly similar to what would be given by so many standard sperm candles burning in a similar apartment, so that a number of readers, or watchmakers, or sempstresses, would be able to pursue their respective occupations with equal facility in either case, I fail to comprehend how there can be so wide a difference of opinion on the comparison of the illumination of two such rooms as the ratio of 2,000 to 700 implies. Surely there could be no doubt as to the amount of illumination in two similar rooms, one lighted by 2,000, and the

other by 700 candles; and if the above understanding of candle-power be correct, there should be no difficulty in determining the candle-power value of an electric lamp; but if the term candle-power does not imply a practical equivalent to the light of a sperm candle, or at least some tangible standard, as in the case of horse-power, the term seems to me utterly useless in assisting the ordinary public in judging of the illuminating value of any electric lamp. For it can matter little whether a lamp be dubbed as being of 20, 200, or 2,000 candle-power, if it does not enable the workmen in a factory to carry on their work as well as they could by the use of so many candles.

If this be true, the only practical means of judging of the comparative values of different electric lamps will be by ocularly comparing their effects with each other, and with those of gas, which means, after all, will have to be the one by which the decision as to the general adoption or rejection of the electric light in respect of its illuminating power will be arrived at.

When the great *début* of electric lighting in the City took place, I, in common with many others, made this rough-and-ready test of the various lamps, without knowing anything of the claims of the champions of the different systems: I came to the conclusion that that part of Cheapside lighted by the Brush lamps was more brilliantly illuminated than that lighted by the Siemens lamps, but not to a much greater extent than might be accounted for by the employment of reflectors. You may, therefore, be able to judge somewhat of my surprise on learning that 2,000 candle-power is claimed for the Brush lamp, and 300 candle-power for the Siemens. I do not say that either of these figures is not true. But I do say that if they are true, there is something about figures in connection with candle-power quite outside the ordinary rules of arithmetic, and incomprehensible to the public mind; as I have not found any one who would admit there was anything approaching *three times* as much light in the "Brush" part of Cheapside to that of "Siemens," let alone more than *double three times that quantity*.

I see that the engineer of the Brush Company states, in the current number of the Review, that Messrs. Ayrton and Perry, "by their improved method of determining the candle-power of electric lights, have found that the ordinary Brush lamps yield 2,000 candle-power each." In the Review of May 27th it is stated, apparently by some one in authority, that the "words 2,000 candle-power on the Brush prospectuses refer to the candle-power of the naked light. But if the lamp is surrounded by an opal globe, as is usually the case, the light is of about 1,000 candle-power."

It is evident from this that the Brush figures must be considered as being similar to the published price of music, and that, even then, these (having regard to a foot-note in their price-lists that "the candle-power of lights is measured with the carbons in their best position") must be only taken *cum grano salis*.

As the truthful solution of this question is of great importance to the practical development of the electric light, it seems a pity that some of our great scientists, who would be above equivocation, do not give us some reliable standard for practical purposes, by which the claims for different lamps put forward by those who are making haste to get rich might be easily tested, and appreciated accordingly.

I inclose my card, and remain,

Your obedient servant,

MATHETES.

NOTES.

ON THE LENGTH OF THE SPARKS FROM THE DISCHARGE OF A CONDENSER.—By M. E. Villari.—If we discharge a condenser by causing it to produce a spark or two, the length of the first is not equal to the sum of the lengths of the latter, and the sum of the lengths of the sparks is not always constant. I call the exciting-spark that which is produced against the exciter, and the conjunctive spark that which takes place at an interruption of the connective arc. When the conjunctive spark L is zero, the sum L + L′ is a minimum, about 26 millimetres. When one of the two sparks L or L′ is very small (less than 2 millimetres) the other spark is elongated excessively, so that the sum L + L′ attains a maximum value equal to about 40 millimetres. For the value of each of the sparks comprised between 3 and 30 millimetres, the sum, L + L′, is mean and constant, and is equal to about 32 millimetres. Small sparks have the effect of elongating another spark which is produced at the same time in the circuit. This influence increases with the charge of the condenser. The elongation of the exciter-spark of a condenser produced by a small conjunctive spark is connected with a sensible decrease of the internal discharge of the condensers and an increase of the external discharge. When a jar is discharged through a circuit with a short interruption, the heat of the internal discharge diminishes sensibly, and the heat of the external exciting spark augments; and if to this we add the heat of the very small spark, we comprehend readily that the energy of the discharge is very great.

In the case of two external sparks of sufficient length their sum is constant, as the author has formerly shown indirectly by measuring the thermometric dilatations produced by the two sparks. It follows that the total thickness of the stratum of air traversed under these conditions is constant; this is why the total work performed by the discharge should remain constant so long as the diameters of the sparks do not change. Hence the discharge should be, as it is in fact, independent of the length of one of the two sparks.

Further, if we consider the length as a constant sum, about 32 millimetres, we shall find that it is much superior to the single exciting spark of 26 millimetres produced in a continuous circuit. M. Belli has previously remarked that the length which represents the sum of several sparks from the discharge of a bottle is greater than the single spark; and as the internal discharge remains constant when there are produced at the outside one or two sparks sufficiently long, we may admit as probable that the sum of the length of the two sparks is greater than the single exciting spark, for the former present a resistance smaller than the latter. Such a phenomenon may perhaps depend on the metallic vapours which accompany the spark, and which increase with the number of interruptions.—*Comptes Rendus.*

EXPERIMENT TO SHOW THAT AIR SATURATED WITH MOISTURE INSULATES LIKE DRY AIR.—By G. MARANGONI.—Watery vapour is generated in a flask and passed into a glass bell by means of a tube bent slanting downwards. Into the bell a small Leyden charged jars introduced with its knob. In a few seconds it is completely discharged. But if before charging, the jar is heated at its edge by a flame to about 212° F., then charged and introduced into the bell full of steam, it retains its charge, as no superficial conduction takes place.—*Wiedemann's Beiblätter.*

TELEPHONIC LITIGATION.—Under this heading, in our issue of June 10th, we mentioned that the London Globe Telephone Company had applied for an injunction to restrain the United Telephone Company from issuing, to their subscribers, certain statements. These statements, we are informed, were these:—

> The United Telephone Company have been advised by eminent counsel that all forms of transmitter in which carbon is used in a free or powdered form, as for instance in the transmitters usually known as Moseley or Hunnings, and that all the so-called microphone transmitters, including those known as the Crossley and the Gower-Bell, are infringements of Mr. Edison's patent of 30th July, 1877, No. 2909, as amended by disclaimer.
>
> No form of magneto-telephone, and no form of transmitter in which carbon or any other equivalent substance is employed, whether known as Edison's, Moseley's, Hunnings', Crossley's, Gower's, or by any other name, can be manufactured, sold, supplied, or used in this country, except under licence from the United Telephone Company, Limited. Proceedings will be taken against persons infringing the company's patent and other rights as above set forth.

The case came before Mr. Justice Fry on Thursday, the 15th, and was adjourned to allow an affidavit, as to damage, being filed. On being again brought before Mr. Justice Fry on the 22nd instant, the injunction was granted in the following terms:—

"The questions I have to decide are two: The first is, are defendants acting honestly in asserting their right to issue notice complained of. As to the second case, they

(plaintiffs) have to satisfy me: Are they sustaining any injury from the publication of this notice.

"I determined in the action before, that Hunnings' transmitter could be manufactured, sold, supplied, and used in this country without a licence from the United Telephone Company.

"I therefore rightly or wrongly determined the very opposite of the propositions there put forth. However great would be my sense of doubt as to the ultimate decision of the case, I must bear in mind that I am a competent judge to decide the case, and as long as the decision stands, I am bound to act on it just the same way as I would on the decision of any other judge. It is suggested that they (defendants) are doing this *bonâ fide*. How stands the matter about *bona fides?* In May the plaintiff complained of the present circular, the judge then read from Mr. Morris's affidavit, in which the solicitors for the defendants inform the secretary of the United Telephone Company that they must change the lists quoted from. Nothing could be more truthful on the part of the solicitors; they advised the company that it was not only advisable but was necessary, and gave what was equivalent to an undertaking that no further lists should be sent out. It seems that Messrs. Eldred & Ormes have since June, 1881, been the assigns of the Hunnings' patent, and that their royalties under this patent have been materially diminished. I am bound to say I do not think that the statement (in the notice) is one which an honest man would ever make. I do not think honest men would desire to say in an unqualified manner that what a competent court had decided to be false to be true. If, notwithstanding my decision, they had stated their opinion as to the superiority of the decision of Lord M'Laren to that of mine, or that they had in any way indicated that a court of competent jurisdiction had decided contrary to mine, no objection could be taken. I come to the conclusion that the company are not honestly asserting their rights when they assert a right to maintain this passage after my decision."

The judge then said that he would have to grant an injunction restraining the United Telephone Company, Limited, from issuing such notices, unless they appended thereto Justice Fry's decision to the contrary.

THE TELEPHONE COMPANY OF IRELAND.—The *Pall Mall Gazette* pithily says:—"After the decision recently given in the court of Mr. Justice Fry, it must have required a little assurance on the part of the compilers of the Telephone Company of Ireland's prospectus to assert that it would enjoy 'a practical monopoly.' Of what will this monopoly consist? It is a fact already notorious in the City that rivals of the United Telephone system—people who claim to begin with their inventions where those it possesses left off—are making and selling instruments without let or hindrance, and ready to do business for all comers the moment the Post-office officials grant a licence. The delay in granting this licence, indeed, is already raising murmurs about 'backstairs influence' which are not pleasant to hear, but of the power of mere patents to check free competition one does not now hear a word. For what, then, does the Telephone Company of Ireland pay £150,000 in fully paid-up ordinary shares to its promoters? Surely this is a disproportionate sum, even were the company to enjoy 'a practical monopoly,' for its total cash capital is to be only £25,000 in £1 preference shares.

BARNEY'S TELEPHONE.—A few days since we had an opportunity of trying this instrument, an abstract of the patent specification of which appeared on p. 408 of our issue of June 3rd, 1882. We were unable to test it with the transmitter which Major Barney has designed for use with it, but with an ordinary carbon pencil transmitter the articulation was very good and the power all-sufficient. Before our next issue we hope to have made further trials with it. In the meantime we may remark that, to us, this form of receiver appears to be quite outside the amended Bell patent, as no plate capable of inductive action is used.

A TELEPHONE CONTROVERSY.—Before Judges Lowell and Gray, in the United States Circuit Court, the case of the American Bell Telephone Company against Prof. Amos E. Dolbear, of Tuft's College, *et. al.*, came up. The complainants allege that the Dolbear telephone is an infringement upon the Bell patents, and move for an interlocutory injunction. The claim of the defence is that the two methods of telephoning speech are essentially and radically different, being based upon different electrical laws; that the latter uses the energy of the sound waves to control the electricity on a circuit, instead of converting that energy into magnetic variations.—*The Operator.*

ELECTRICAL APPOINTMENT.—Mr. William Kingsland, A.S.T.E. & E., late superintending electrician to the Hammond Electric Light Company, Limited, has been appointed electrical engineer to the Yorkshire Brush Electric Light and Power Company, Limited. Mr. Kingsland will be remembered in connection with the installation of the Brush and Lane-Fox lamps at Chesterfield, where he was in charge, at a critical moment, when the gas had been cut off by the local authorities, and the town left in darkness, during the month of September last.

THE ELECTRIC LIGHT IN MADRID.—The electric lighting of the War Office at Madrid was successfully inaugurated on the evening of the 11th inst. The Sociedad Espanola de Electricidad, to whom the work was entrusted, will continue to supply the light for the same amount that has hitherto been paid for gas, and in addition to having successfully introduced the electric light into the Madrid War Office, is now carrying out experiments towards lighting the principal streets of the capital. Several shops and a large café at Barcelona have been fitted by the same company with Swan lamps, the current being supplied from a central station. The light has been received with great satisfaction by the public, and from the moderate terms charged by the contracting Company a great extension of the system can be predicted.

ELECTRICITY AND THE TRAMWAYS.—A well-known tramway authority, in giving evidence before a Committee of the House some days ago, gave it as his opinion that before ten years every tramway in England would be worked by steam-power or by electricity; and he had little doubt that electricity will before long be used as a motive power on more than one of the lines where the use of mechanical power has been granted.

THE JABLOCHKOFF ELECTRIC LIGHT.—It is stated that the Jablochkoff Electric Light Company have received an offer of £100,000 for their patent rights for Scotland, this being equal to two-thirds of the total sum paid for the patent rights for the whole of Great Britain and the Colonies.

THE BRUSH LIGHT.—It is understood that the South-Eastern Brush Electric Light Company are in treaty for the sale of their rights for the Croydon and Crystal Palace district, and that they expect to be successful in obtaining a contract for the lighting of the district of Lewisham.

THE ELECTRIC LIGHT IN MEXICO.—It is stated that the Mexican Chamber of Deputies has been lighted by means of electricity for some weeks past.

THE ELECTRIC LIGHT IN THEATRES.—Following the lead of the Savoy Theatre, the Philharmonic, at Islington, proposes to use the electric light for the future.

THE ELECTRIC LIGHTING BILL.—In the House of Commons, on Monday last, Colonel Makins gave notice that, on the motion for going into Committee on the Electric Lighting Bill, he would move that it was undesirable to retain in the bill the novel power proposed to be given to the Board of Trade to grant licences to local authorities, companies, or persons, enabling them to exercise powers which have hitherto been only granted by Acts of Parliament, or Provisional Orders affirmed by Acts of Parliament, and that the bill be referred back to the Select Committee, with instructions to strike out all provisions which authorised the granting of such licences by the Board of Trade.

THE ELECTRIC LIGHT AT PRESTON.—We understand that Messrs. Brindley & Co., of the Alliance Works (Weaving Mills), have ordered a dynamo-electric machine, and 6 Pilsen lamps, to be fitted up in their factory; and if this preliminary installation is successful, twenty more Pilsen lamps, with the necessary machines, will follow.

ELECTRIC LIGHT FOR SHIPS.—Messrs. Siemens Bros. seem to be doing a brisk business in fitting electric lights for Navy purposes. We recently saw a considerable number of their dynamo machines in course of being fitted direct on to the well-known 3-cylinder engines of Mr. Peter Brotherhood.

THE ELECTRIC LIGHT IN THE CITY.—At the fortnightly meeting of the Commissioners of Sewers, on Tuesday last, a memorial was presented, signed by a number of leading merchants and traders of the City, praying that the Commissioners will give their permission for the systems of electric lighting about to be set in operation for public lighting to be also utilised for the convenience and benefit of private houses. Mr. Evans, C.C., who headed the deputation, said there was a general desire amongst the leading warehousemen of the City, having in view the decision come to by the Commission with regard to public electric lighting, that they should be permitted to have the benefit of private electric lighting without incurring the anxiety and expense of introducing special dynamo machines on their premises. A good argument in support of the memorial was put forward by Mr. B. F. Barber, who, in reply to Mr. Innes, said they were unable to match their goods by gas, and he had had to send his matching men down to Ludgate Hill to get the benefit of the electric light. This was a great hindrance in winter, when he had sometimes been idle for five days in succession.

It was moved that the matter be referred to the Streets Committee. In regard to the street lighting of the City in the extended districts, an abstract of the engineers' report was submitted, from which it appears that the cost for twelve months, including the fixing of machinery, lamps, &c., ranges, in district No. 1, from £2,190 to £5,750, as against the present cost of gas, £551; district No. 2, from £2,350 to £4,270, as against £363 for gas; district No. 3, from £2,470 to £3,800, as against £341 for gas; district No. 4, from £2,920 to £4,350, as against £612 for gas. Some of the companies couple with their tender a request to be allowed to light private premises within the district, and in that case the company offer to make the charge for lighting, irrespective of the machinery, &c., the same as for the gas saved plus 20 per cent.

THE COST OF THE ELECTRIC LIGHT.—We read in the *City Press* as follows:—

There are strange rumous floating about the City in relation to electric lighting that would seem to require close investigation. . . .

On February 24th last, Lieut.-Col. Haywood, the Engineer to the Commissioners of Sewers, presented a preliminary report on the results of the contracts for electric lighting, which was published on March 21st. No. 2 district not having been completed, may be omitted from further notice, but No. 1 and 3 showed the following startling facts.

No. 1, the Brush system, with an illuminating power, as stated by the company, of 66,000 candles, cost £1,410. No. 3, the Siemens system, with an illuminating power, as stated by the company, of 38,400 candles, cost £3,720. With these extraordinary results it is scarcely surprising to find that the shares of the Brush Company, £10 paid, which just before the date of this report were quoted at from 20½ to 21¼, rapidly rose to from 55 to 60. . . . .

The Brush Company agreed in February last to continue the lighting of district No. 1 for another year, but have since, it is stated, absolutely refused to tender at any price for either of the other districts!

The £1,410 charged by them for lighting No. 1 district is divided as follows: For providing and fixing machinery, lamps, &c., and removing same at expiration of contract, £750; for electric light from sunset to sunrise, £660; total £1,410. How an illuminating power of 66,000 candles can be supplied for twelve months, from sunset to sunrise, with a profit, for £660, is a marvel to many of the most eminent electricians of the day. One has gone so far as to say that, in his opinion, it cannot be done at less than three or four times that price.

However that may be, one of two things is clear, either the Brush contract was carried out at a loss or at a profit. If at a profit, why does the company absolutely refuse to extend it? If at a loss, should not its numerous progeny be made acquainted with the interesting fact?

No doubt these matters can all be satisfactorily explained, but explanation is what they certainly require, and that of the fullest and clearest character.

THE JABLOCHKOFF LIGHT IN PARIS.—Parc Monceau, the prettiest of the Paris public gardens is, by a decision of the municipality, to be lighted up with Jablochkoff's electric light, and to remain open till 2 a.m.

DIRECTORS OF ELECTRIC LIGHT COMPANIES.—Mr. William Crookes, F.R.S., has joined the board of the Gülcher Electric Light and Power Company, Limited. Mr. George Inverarity and Mr. Hugh Watt have joined the board of the Electric Light and Power Generator Company, Limited, in the room of Mr. John D. Pender and Mr. M. Low.

LIGHTING OF STAFFORD HOUSE BY THE ELECTRIC LIGHT.—Stafford House, the London residence of the Duke of Sutherland, was experimentally lighted by electricity on the evening of the 16th inst. The Duke of Sutherland invited a large number of gentlemen to witness the experiment, which was begun at ten o'clock, and continued till after midnight. The total number of lamps in use was 258, each of 20 candle-power. The picture gallery, which is 123 feet in length, was lighted by 176 lamps, and in the banqueting-room, which is 62 feet long, there were 73 lamps. Six Gramme machines, driven by an engine of 20 horse-power, were used. The guests were shown that there was danger from coming in contact with the wires, and that the lamps could be separately or collectively extinguished or removed at will. There was an absence of fluctuation in the lights; and although opinions differed as to the merits of the light, general satisfaction was expressed at the success of the experiment. The experiment was carried through by the British Electric Light Company. We shall deal more fully with this installation in our next issue.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.—The India-rubber, Gutta-percha, and Telegraph Works Company notify the receipt of a telegram from Mr. R. K. Gray, their engineer-in-chief, dated Panama, the 13th inst., and in which it says that the ss. *Silvertown* and the ss. *Retriever* were then both coaling at Panama, and that the Buenaventura-Panama section was expected to be completed by the 20th inst. All well.

MEXICAN CABLES EXTENSION.—The India-rubber, Gutta-percha, and Telegraph Works Company have received a telegram informing them of the successful laying, by their ss. *International*, Mr. Theophilus Smith, engineer-in-charge, of her part of the cable for the Mexican Cables Extension. The *International* intended to steam to Brazos, to proceed with the operations of splicing the Tampico-Brazos section to the cable she has just laid to Galveston. All well on board.

THE TELEGRAPH STEAMER "CAROLINE."—The *Caroline*, lately employed in the coal trade, is once more moored off Messrs. W. T. Henley's Telegraph Works, at North Woolwich, where she is now being fitted out for a cable-repairing expedition to the Mediterranean. We understand that she has been chartered for the repairs of the Otranto-Corfu cable, interrupted since the 19th ult.

THE CABLE SHIP "FARADAY."—The ss. *Faraday*, belonging to Messrs. Siemens & Co., came up the river Thames, from the Atlantic, on the 5th inst., and arrived off the Charlton Works on the 10th inst. She is now discharging stores, &c., and we understand that she will go afterwards to the Millwall Docks, where she will receive new boilers.

ELECTRICAL LABORATORY IN PARIS.—M. Cochéry, the French Minister of Posts and Telegraphs, has decided that the electrical laboratory, established with the proceeds of the late electrical exhibition, will be placed in the Bois de Boulogne. The reason alleged is the necessity of avoiding the shaking of the ground by the passing of carriages, so frequent in Paris. The establishment will be open to the public under certain limitations and regulations, which are to be printed in the *Journal Officiel*.—*Nature*.

THE ROYAL SOCIETY OF EDINBURGH.—At the fourteenth ordinary meeting of the Royal Society of Edinburgh, held on Monday evening last, Lord Moncrieff, President, presented the Keith prize for the biennial period 1879-81 to Professor Chrystal, for his paper on "The Differential Telephone." Professor Tait, in stating the grounds on which the Keith prize had been awarded, said that, apart from the purely scientific point of view, the great merit of Professor Chrystal's paper was its practical nature, and if the paper had stood solely upon its practical merits he thought the award would be justified. In a short note, Mr. A. Macfarlane, D.Sc., stated the outcome of experiments related in his paper on "The Effect of Moisture on the Electric Discharge" to be such as to justify the conclusion that the drying of the air increases the resistance to the disruptive discharge.

CALLENDER'S BITUMEN AND TELEGRAPH WORKS CO.—Last week we paid a visit to the factory of Callender's Company at Erith, for the purpose of inspecting a new insulator prepared from crude Bitumen, the manufacture of which is likely to assume considerable importance. As far as we can judge at present it appears admirably adapted for covering electric light leads, telephone wires, &c., and its cheapness will make it a formidable rival to gutta-percha and india-rubber. We hear very good reports as to its insulating properties and general adaptability for the purposes for which it is intended, and we shall shortly have something further to say about its capabilities.

TELEGRAPHS IN PALESTINE AND ARABIA.—The telegraph lines in Turkey make great progress. The opening is announced in Palestine of three telegraph stations, viz. Nazareth, Tiberiade, and Safié. In Arabia they are waiting for the material ordered in Europe, for the construction of the system of telegraph lines in the province of Hedjaz. Part of this material is intended for the first lines from Jiddah to Mecca, and from Mecca to Yenbo and Medina; the rest, which will be used to connect the projected lines in the province of Hedjaz with the existing lines in the province of Yemen, will be forwarded with the submarine telegraph cable now being made at Messrs. Siemens' works, of London. We have mentioned already that this cable is to be laid between Jiddah and Sawakim, across the Red Sea, to establish the connection of the lines in Yemen with the Egyptian landlines, which have now been in communication with the telegraph lines in Syria for some considerable time.—*La Lumière Electrique.*

ELECTRICAL RAILWAY IN HOLLAND.—In Holland the firm of Siemens and Halske, of Berlin, have supplied the necessary machines and carriages, intended for an electrical railway, the first that has been tried in the Netherlands. This electrical railway goes along the coast of the North Sea, from the watering-place of Zandvoort (a station of the Haarlem-Zandvoort Railway) to the Park Kostoerloren. The opening of this electrical railway, which is two kilometres long, will shortly take place.—*La Lumière Electrique.*

EXHIBITION IN FALMOUTH.—The Jubilee Exhibition of the Royal Cornwall Polytechnic Society and the Fine and Industrial Arts, will be opened at the Polytechnic Hall, Falmouth, on Tuesday, September 5th, 1882. The Exhibition will be on an extensive scale, and the committee have determined to make it representative of the progress of the past half century in science and art, mining enterprise, naval architecture, and fishing; meteorology, photography, natural history, and statistics, as well as the fine arts pure and applied, more especially in connection with the county of Cornwall. The exhibition will be attended by men eminent in science, who will come to Falmouth after the British Association Meeting at Southampton, several of whom will deliver lectures at the Jubilee. Electricity and the electric light will be a special feature of the exhibition. The exhibition itself will occupy the Polytechnic Hall and the Volunteer Drill Hall, and will be open for double the ordinary period. Excursions on a large scale will also be organised for exploring the sea coast, the scientific and archæological interest, and the natural beauties of the neighbourhood. In order to insure success, the committee with confidence solicit the aid of all Cornishmen. They estimate that £600 will be required to carry out the object in view.—*Nature.*

THE ELECTRICAL EXHIBITION OF MUNICH.—It has been announced that an electrical exhibition was to take place in Vienna at the very same time that the one in Munich will be held. So as to prevent, however, these two exhibitions being held at the same time, and thereby prejudicing each other, the committee of the Vienna exhibition have determined to delay theirs until the months of August, September, and October, 1883.

The preparations for the exhibition in Munich are carried on with great activity, and the committee charged with the installation receive from all sides the support of the large Government administrations.

The general administration of posts, telegraphs and railways in Bavaria place at the disposal of the committee a trial train for the lighting of the carriages and engines, and also long telegraph lines for the trial of telephonic systems. The longest of these lines, from Munich to Dresden, will be some 550 kilometres long. This administration will further undertake to put up, at their own cost, the necessary wires for hearing the different representations at the theatres, and to lay the conducting wires intended for the transmission of force. It is their intention to avail themselves for this purpose of the water-force of the river Isar, estimated at 3,000 horse-power, and to prove that it is possible to make use of it to light, at a distance of several kilometres, the streets and houses, and to distribute the force to the different workshops.

As regards the lighting of the streets, a committee has already been nominated, charged to study at the exhibition the different systems of electric lighting, and to decide whether they should, later on, be tried in the streets of Munich, which, no doubt, would offer a great advantage, considering the relatively high price of gas in that town.

Finally, the administration of the royal theatres is organising in the exhibition building itself a theatre, intended for experiments with the electric light, and for studying the means which electricity offers to lessen the chances of fire.—*La Lumière Electrique.*

TELEPHONIC COMMUNICATION BETWEEN ABERDEEN AND COVE.—At a meeting of the Dock and Pilotage Committee of Aberdeen Harbour Board, held on Thursday, the 8th inst., the question of establishing telephonic communication between the Captain Pilot's house and the Cove came up for consideration. A report was submitted, from which it appeared that the Board of Trade had been communicated with upon the subject, and that they had sent down an official to make investigations on the advisability of the scheme. This official has reported entirely in favour of the proposal, but at the same time he suggests that a wire should also be carried to the coastguard station at Donmouth, so that there may be direct communication when necessary, in case of shipwreck, between Cove and Aberdeen and Donmouth. If the Harbour Board agrees to this proposal, the Board of Trade will be recommended to defray one-half of the total yearly expense. The Committee, we understand, agreed to adopt the suggestion, and when the Board of Trade have officially signified their acceptance of it, the extensions will be carried out. It is calculated that the annual cost will be about £40, of which, according to the proposed arrangement, £20 will be paid by the Harbour Board and £20 by the Board of Trade.

THE TELEPHONE IN SCOTLAND.—Notwithstanding the many difficulties with which the National Telephone Company has had to contend with in Scotland, that success which is the reward of unwearied perseverance appears about to be theirs. Having succeeded in establishing communication between their Forfar and Dundee exchanges, they now propose to extend their Dundee radius, so as to embrace Broughty Ferry and West Ferry, and their Forfar radius to include Kirriemuir and Brechin; and we understand communications have already been addressed to the Post-office asking for the necessary permission. It is stated that within the past fortnight upwards of forty new subscribers have

been secured in Dundee. In Edinburgh the progress, if not so great, is marked ; and in Aberdeen, where the formation of various centres is under consideration, the Watching and Fires Committee propose to recommend to their Town Council the desirability of having their police stations telephonically connected with the central exchange. In the West of Scotland like advancement is to be seen, and one of the most gratifying points in connection with these extensions is the very substantial and workman-like way in which the wires are being erected. Certainly the experience of the last two or three years has not been lost, and we wish the National Telephone Company a speedy return for their present outlay.

NEW COMPANIES REGISTERED.

ELECTRIC NEWS TELEGRAPH COMPANY (LIMITED).—Office : 4, Ludgate Circus. Capital, £150,000, in £5 shares. Objects : To purchase the plant, patents, and other property of the Automatic Telegraph Company (Limited) for £36,000 in cash and shares. Signatories (with one share each) : C. W. Kirk, 148, St. Paul's Road, Camden Square ; F. P. Lennen Javal, 59, Bryanston Street, Hyde Park ; E. Shepherd, 21, Shrubland Grove, Dalston ; B. P. Daniels, 7, Poultry ; E. Leworthy, Yatton Lodge, Herne Hill ; H. Fleet, 7, St. John's Church Road, Hackney ; J. W. Tricker, Croydon. Directing qualification : £250 (nominal) in shares or stock ; remuneration, £250 per annum to the chairman, and £150 per annum to each director, and £10 per cent. bonus on excess of dividends exceeding £10 per cent. per annum. Registered 15th inst., by Harries, Wilkinson and Raikes, 24, Coleman Street, E.C.

JARMAN AND COMPANY (LIMITED).—Capital, £2,000, in £1 shares. Objects : To manufacture and deal in electric lamps, dynamo-electric machines, and other electrical apparatus, and for such purposes to adopt an agreement of the 15th inst. between Alfred James Jarman and William John Lavington. Signatories (with one share each) : C. C. Baker, 40, Overbury Street, Clapton ; M. F. Dormer, 6, Fernlea Road, Balham ; F. T. Bennett, 14, Park Villas, West Dulwich ; C. R. Bennett, 8, Brunswick Square ; J. H. Nicholls, Victor Road, Kensal Green ; G. R. Hearn, Selhurst ; G. J. Nicholls, 14, Portnall Road, St. Peter's Park, W. Registered 17th inst., by G. J. Batters, 76, Old Broad Street.

BRUSH ELECTRIC LIGHT COMPANY OF IRELAND (LIMITED).—Office: 31, Lombard Street. Capital, £250,000, in £5 shares. Objects : To acquire a concession from the Anglo-American Brush Electric Light Corporation (Limited) upon terms of an agreement, of the 19th inst., between R. M. Phillips and Henry Newsome Myers. Signatories (with one share each) : J. D. Shakespear, J.P., Empire Club ; J. N. Harrington, Middle Temple ; J. R. Brown, Junior Army and Navy Club ; H. N. Myers, 4, Sunny Bank, East Dulwich ; S. Vyle, Middlesborough ; R. H. M. Phillips, 8, The Crescent, North Finchley ; F. Ince, St. Benet's Chambers. Directing qualification : fifty ordinary shares or £250 stock. The signatories are to appoint the first directors. Remuneration : £1,500 per annum, and one-tenth of all divisible profits over the first £10 per cent. Registered 20th inst., by Ingledew and Ince, St. Benet's Chambers; Fenchurch Street.

GENERAL TELEGRAPHIC NEWS COMPANY (LIMITED).—Capital, £80,000, in £10 shares. Objects : To purchase the business and property of MacMahon's Telegraphic News Company (Limited), and to acquire the right to use the patents or instruments of the Exchange Telegraph Company (Limited). Signatories (with one share each) : K. L. M. Anderson, 10, Throgmorton Avenue : A. R. Hardie, 66, Old Broad Street ; G. R. Neilson, 6a, Mostyn Road, Brixton ; H. A. C. Saunders, 107, Grosvenor Road, Canonbury ; F. H. W. Higgins, 88, Farleigh Road, Stoke Newington ; J. T. Carpenter, 4, Queen Anne's Terrace, Westbourne Park ; H. J. Muirhead, 10, Throgmorton Avenue. The signatories are to nominate the first directors. Qualification : £250 in shares or stock ; remuneration : £150 per annum to each director. Registered 20th inst., by Bischoff and Bompas, 4, Great Winchester Street.

NEW PATENTS—1882.

2803. "Dynamo-electric machines." F. L. WILLARD. Dated June 14.

2804. "An improved method of, and means for, employing electricity for telegraphic and telephonic purposes." W. R. LAKE. (Communicated by F. van Rysselberghe.) Dated June 14.

2807. "Secondary batteries." L. EPSTEIN. Dated June 14.

2817. "Improvements in, and in connection with, burglar alarms." J. BLOMERLEY. Dated June 15.

2818. "Secondary batteries." J. S. SELLON. Dated June 15.

2823. "Producing electric currents by means of gas." C. WESTPHAL. Dated June 15.

2827. "Wire ropes." F. C. GUILLEAUME. Dated June 15.

2830. "Improvements in the construction and government of electro-motors, or machines, which convert electrical energy into mechanical energy." W. E. AYRTON, J. PERRY. Dated June 15.

2845. "Incandescent lamps." A. PFANNKUCHE. Dated June 16.

2871. "Dynamo-electric machines." J. E. H. GORDON. Dated June 17.

2875. "Improvements in gas batteries and in apparatus for the production of hydrogen and oxygen by electricity, and for the production of artificial light." R. J. GÜLCHER. Dated June 17.

2877. "Improvements in electrical apparatus for ascertaining the depth of water, which improvements are partly applicable for other purposes." W. R. LAKE. (Communicated by L. G. Coffinières de Nordeck.) Dated June 17.

2885. "Dynamo-electric and electro-dynamic machines." J. A. BERLY. (Communicated by F. V. Maquaire.) Dated June 19. (*Complete.*)

2887. "Counting or checking apparatus, part of which invention is applicable for bells or gongs used for other purposes." F. PETERSEN, J. H. R. DINSMORE. Dated June 19.

2896. "Shunts or switches for protecting telegraphic and other electrical instruments from the effects of abnormal or excessively powerful currents." C. T. HOWARD. Dated June 19.

2897. "Manufacture and construction of incandescent electric lamps and machinery or apparatus to be employed therein." A. SWAN. Dated June 19.

2902. "Improvements in electric meters, partly applicable to gas-meters." J. T. SPRAGUE. Dated June 19.

2905. "A new telephone, to be called 'The Snell Receiver.'" W. H. SNELL. Dated June 20.

2907. "Electric telephony." J. G. LORRAIN. (Communicated by A. Dunand.) Dated June 20.

2910. "Machinery or apparatus for generating and utilising electricity." C. E. KELWAY. Dated June 20.

2911. "Means of carrying electric wires through streets." J. KINCAID. Dated June 20.

2912. "Apparatus for the regulation of electric currents." S. H. EMMENS. Dated June 20.

2913. "Secondary batteries." S. H. EMMENS. Dated June 20.

2914. "Improvements in electric lamps and in appliances relating thereto." S. H. EMMENS. Dated June 20.

2917. "Improvements in dynamo electric machines and electric motors and in the means of storing the energy of the electric currents." T. PARKER, P. B. ELWELL. Dated June 20.

2934. "Improved means of suspending or mounting electroliers and other electric light fittings." A. W. BREWTNALL. Dated June 20.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

4607. "Magneto-electric machines." H. F. JOEL. Dated October 21. 6d. Relates to improvements in magneto-electric machines, whereby they are rendered less costly in construction and maintenance, and the force of the generated current is improved, and especially to that class of magneto-electric machines which produce continuous currents by the aid of special commutators as distinguished from magneto-electric machines which produce alternating currents or currents of constant direction and power. The improvements are essentially in the construction of the frame, the field-magnets, the revolving armature, the commutator, and the brushes and frames; and further, in the novel disposition of the magnets relatively to the armature, and in the method of connection between the armature coils through the commutator. Fig. 1 shows a side elevation of one form of the improved dynamo machine. Upon an iron base-plate, A, are mounted two upright standards, B, one at each end, upon which plummer blocks, *b*, are fixed to carry the axle of the revolving arma-

ture, so that the armature may be easily taken out when desired without disturbing the rest of the machine. Upon the base-plate, A, four upright field electro-magnets, C, are mounted, braced across the top by the iron plate, *a*. The magnets, C, are arranged in pairs, with

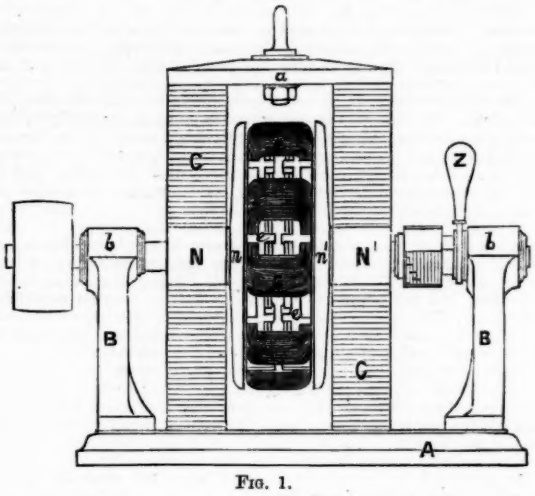


FIG. 1.

the wire so coiled as to make the north and south poles of each pair in the centre of the magnets and opposite to one another, as shown at N and S. To these poles are attached extending pole plates, *n*, *s*. The revolving armature is shown in detail in fig. 2, a half-front elevation. This armature is constructed in eight or many distinct sections, D, D^1, D^2, D^3, &c. The cores consist of small plates, E, constructed in sets

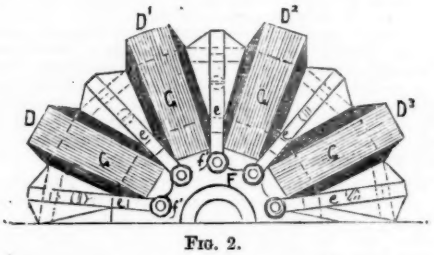


FIG. 2.

of four, fixed together in parallel and opposite pairs (with a space between), each pair being composed of two plates half overlapping, and across the middle is coiled the insulated wire, G. A series of separately wound sections with projecting ends is thus formed, and these sections are fitted one to the other in a continuous double ring of iron cores, E, of flat surface, and the projecting ends of each section alternately overlap and are attached to those of the next. All bolts, *f*, fixing the opposite plates of the double ring must be of non-magnetic material, so as to preserve the two sides in magnetic insulation. The ring thus formed is carried upon radial spokes, F, of non-magnetic material, and the fitting screws, *f*, serve the double purpose of attachment to the spokes and connection of the overlapping ends of the sections. These coiled sections are interspaced by special iron cheeks, *e*. These cheeks, *e*, bind and fix the sections together so as to make a complete ring armature and cover the heads of the smaller internal screws. They are constructed with a lip, to bite the inside top faces of the exposed portion of the overlapping plates, and are secured to the spokes by the brass bolts, f^1. Figs. 3 and 4

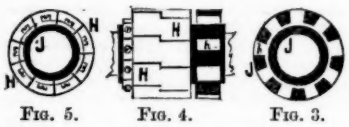


FIG. 5. FIG. 4. FIG. 3.

show an improved form of commutator. It is constructed of separate pieces of metal, H, fitted on a ring of insulating material, J, shown black, stepped one on to the other in such manner as to form a ring presenting alternately, as revolved, a solid or divided face. These pieces, H, are fixed parallel with the axle of the machine, and have their sides rabbeted or cut down. One of the rabbeted sides receives the screws for attaching the wires, whilst the other allows for the screws, which fix the pieces to the axle. Each part is made interchangeable and easy to be fixed or removed, whilst the whole commutator can be quickly taken off the axle of the machine. In conjunction with my commutator may be constructed upon the same axle therewith a short-circuiting device, figs. 3 and 4. This device consists of an indented wheel, *h*, with the indentations filled with insulating material, *j*, the whole mounted on the ring, J. This device enables the inventor, through a subsidiary brush or brushes, *k*, to short-circuit from the commutator through the exposed metallic portions at the intervals of the insulating material occurring at the time of the increase consequent on the cutting out of the neutral coil. In fig. 1 it will be seen that this commutator is not employed, but that known as "Varley's," consisting of a number of rings corresponding to the number of single or double coils on the armature, with

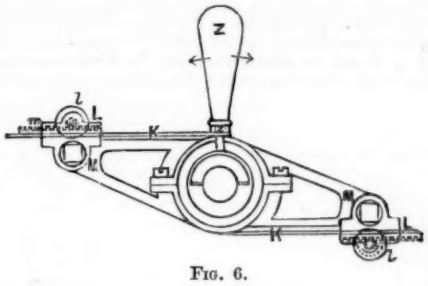


FIG. 6.

insulating spaces for reversing and cutting out the bobbins as desired. The brushes, K, and holders, L, shown in fig. 6, a front elevation, are constructed so as to operate in a single frame, M. They are attached to the top of the machine (conveniently to the

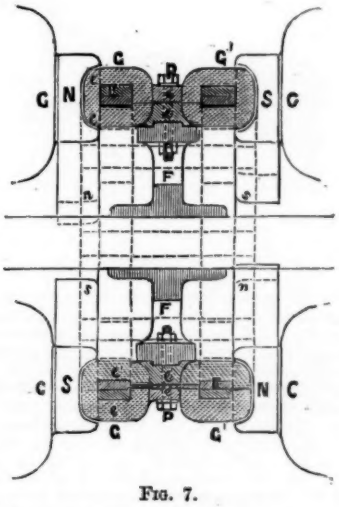


FIG. 7.

brasses of the plummer block, as shown), and are constructed in two halves, so that the brushes and holders can be easily taken apart. A handle, Z, is fitted to enable the whole to be moved round, and by means of a set screw, *z*, at the foot thereof to fix it in any desired position. The brushes are moved separately and independently when desired by means of the rack, *m*, and pinion, *l*.

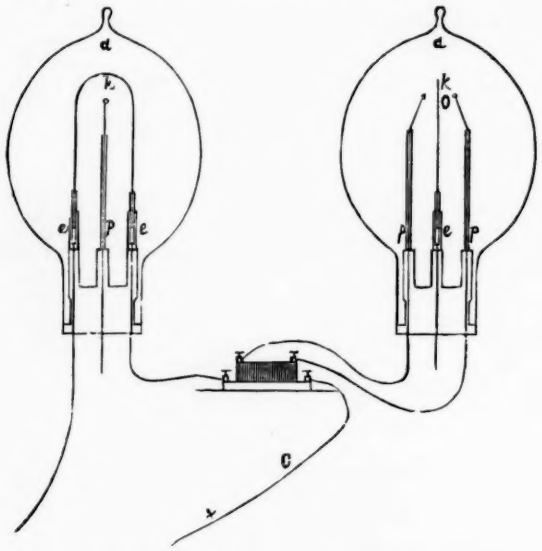
4777. "Electric lamps." E. R. PRENTICE. Dated November 1. 2d. Relates to the construction of an electric lamp, in which the regulation and feed of the carbons are effected by means of fluid pressure governed by the electric current of the lamp itself. (Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.)

4819. "Motors actuated by electricity." W. L. WISE. (A communication from abroad by Emil Bürgin, Engineer, of Basel, Switzerland.) Dated November 3. 6d. Relates to the motor described in the number of THE ELECTRICAL REVIEW for Jan. 14th, page 21.

4882. "Electric time-pieces." W. P. THOMPSON. (A communication from abroad by Monsieur Alphonse Lemoine, of Paris.) Dated November 8. 8d. Has for its object a system of clock, in which the number of working parts is reduced to a minimum, and which strikes the hours electrically without the aid of any barrel, spring, or other motive power besides electricity. In this clock the motion of the pendulum is kept up by the impulses which it receives at fixed intervals suitably regulated from an electro-magnet, in which connection is made with a current from a battery by mechanism fixed upon one of the axes of the wheelwork. This latter consists merely of four movable pieces, two wheels and two pinions, and the pendulum acts directly by means of a clutch or catch upon a ratchet wheel (or escapement wheel) mounted on the axis of the first pinion. The striking apparatus consists of a bell of any kind, the hammer of which is moved by an electro-magnet actuated by a special current. In the circuit of this electro-magnet there is inserted an arrangement which closes the circuit automatically at every hour during the time required for striking worked by one portion of this arrangement.

4942. "Applying electric currents in the production of light, &c." SYDNEY PITT. (A communication from abroad by Lucien Gaulard and John Dixon Gibbs, both of Paris.) Dated November 11. 6d. Has for its object a new method of applying electric currents in the production of light. The incandescent lamps now constructed give for the value of the current employed much less light than can be obtained with the same current by the aid of an arc lamp. It is believed that this phenomenon is due to the dynamo-electric

machines employed as the source, producing a quantity of electricity determined by the volume of the inducting wire, and under a tension dependent on the resistance of this inductor the arc lamp utilises both the quantity of electricity and its tension, whilst the incandescent lamp on the contrary transforms into light only the volume of the current produced. To show the reality of this observation (which is absolutely new, and which has led to the method of applying electric currents in the production of light hereinafter described, and which is claimed) it should be remembered that in a vacuum the static spark shows itself, whatever may be the distance between the con-



ductors. Now in the arc lamp the carbons being in contact and the resistance being sufficient to cause incandescence in these carbons, the heat produced dilates the surrounding air, a relative vacuum is produced at the point of contact, and if the carbons are separated the tension of the current will be sufficient in giving to it the static form, for determining the production of the voltaic arc which serves as a resisting conductor of the current; there are thus two simultaneous luminous effects. In the case of the incandescent lamp on the contrary the static charge of the current passes directly and goes back to the machine without being utilised. As a practical application of this principle, a lamp is constructed according to the following description and the drawing annexed:—A carbon thread, *k*, of which the extremities have been previously coppered in a galvanic bath for the length of about a centimetre, is rendered incandescent by the quantity of the current of the circuit with which it is connected by means of pincers of platinum or other metal, *e*, *e*. Two insulated platinum conductors, *p*, *p*, terminating in small spheres are placed parallel to and in a plane at right angles to that of the wires, *k*, *k*, their extremities facing each other at *o*. The conductors, *p*, *p*, receive the induced current of a Rhumkorff bobbin placed upon the circuit, *c*. In these conditions the static charge only of the conductor, *c*, acting by influence upon the fine wire of the bobbin will determine in the latter an induced current which in the form of a spark will manifest itself at *o* concurrently with the incandescence; thus the total quantity of electricity produced by the generator is utilised. As the figure shows, the system of dynamic and static conductors is inclosed in a globe, *a*, in which a vacuum is produced by the ordinary processes.

4947. "Electro-plating." F. WIRTH. (A communication from Alexander Classen, Doctor of Philosophy and Professor of Chemistry, of Aix-la-Chapelle.) Dated November 11. 4d. Relates to an improved process for the electro-deposition of metals, and in carrying the same into practice the inventor uses, especially for copper, iron, cobalt, nickel, zinc, cadmium, bismuth, lead, tin, and antimony, the solution of chlorides or sulphates (for iron and tin it is immaterial whether a protoxide or an oxide be used) of the said metals are transformed by means of a solution of neutral potassium oxalates into soluble potassium double salts; the solution becomes hot, and in it is dissolved an excess of ammonium oxalate. Later on a small quantity of sodium carbonate is added. The object to be covered or coated is connected with the zinc pole of a battery, and dipped in the bath. The other pole of the battery is connected with a plate of platinum, which is also dipped in the bath. The solutions are then made hot, and the current allowed to pass freely.

4966. "Electrical signalling apparatus for railways." W. R. LAKE. (A communication from abroad by J. B. Johnson, of Boston, America.) Dated November 12. 6d. Relates to electro signalling apparatus for use on railways. According to the said invention a magneto-generator and a rotating armature is provided, adapted to be operated by mechanism which is set for action by the wheels of a train. Heretofore said mechanism has been constructed to operate the magneto-generator after the wheels of the train have ceased to act on said mechanism. The mechanism has been of such construction that in case the train should be moving very slowly or should chance to stop while setting the mechanism, no effective rotation of the armature will take place for the reason that a portion of the mechanism is a lever arranged to be depressed by the wheels of the train, and so connected to the other parts of the mechanism that it requires to assume its original position during the rotation of the armature, and if impeded and caused to slowly assume such position by a slowly moving vehicle wheel the rotation of the armature will be correspondingly retarded and rendered useless. The object of this invention is to enable the mechanism which directly drives the armature to be abruptly released or detached from the mechanism operated by the wheels of the vehicles to set said driving mechanism, so that the said driving mechanism may be released and put in effective action immediately upon being set, the mechanism in rotating the armature being in no way dependent on the rate of motion of the vehicles. To this end the said invention consists essentially in the combination with a magneto-generator having a rotating armature of mechanism for driving said armature mechanism operated by a passing train of vehicles to set said driving mechanism for action, and a tripping or releasing device whereby said driving mechanism is abruptly released from the setting mechanism and put in operation, all of which I will now proceed to describe. In carrying the said invention into practice a magneto-generator is employed, having a suitable rotating armature. The driving mechanism for operating the generator, the mechanism whereby said driving mechanism is set for action, and the tripping or releasing devices, may be variously constructed. The driving mechanism is composed of a gear-wheel on an arbor, journalled in a suitable fixed frame and meshing with a pinion on the shaft of the rotating armature, a ratchet-wheel on the arbor, said ratchet and the gear-wheel being connected so as to rotate together, an arm pivoted on the arbor and bearing a dog and a spring arranged to draw the arm upwardly and cause the dog to engage with and rotate the ratchet. The mechanism for setting said driving mechanism for action consists of a primary lever pivotted near the rail and having its outer end in such proximity to the rail as to be depressed by the wheels of vehicles passing over the rail, a secondary lever pivotted and having one end projecting over the primary lever, and arranged to be operated by the latter, the levers being preferably connected by a link, and a rod pivoted to one of the levers and provided with a tooth adapted to project over a pin on the arm. The tripping or releasing device consists of a projection on the rod and a fixed object or stop arranged to come in contact with the projection when the latter descends. A spring is provided to press the rod against the stop.

4995. "Apparatus for measuring and recording the speed of vessels, &c." C. E. KELWAY and F. DYER. Dated November 15. 8d. Relates more especially to apparatus used for the purpose of measuring and recording the speed at which ships or other vessels are passing through the water, and the distance passed over by them, and it has for its objects improvements in the construction and arrangement of such apparatus whereby its indications are more reliable and more easily observed, and it is more readily adjusted in its position and accessible when required than such apparatus as heretofore ordinarily constructed and used.

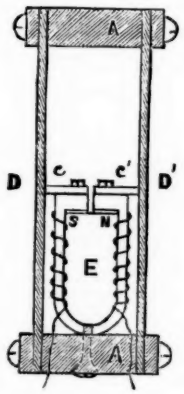
5002. "Dynamo-electric circuits." SAMUEL VYLE. Dated November 15. 2d. Has reference to a more economical and efficacious method of lighting or giving off power by electricity, and is adapted for use in connection with the "Brush," "Siemens," "Jablockoff," and other systems when the lighting is on one side of the machine only, and likewise when the lighting is on both sides the return wire is carried from the point where the end of the last lamp or lamps or motor or motors (as the case may be) back to the dynamo-electric machine. In applying the invention to electric light or power circuits the inventor dispenses with the usual return wire, and connects one end of the wire to the dynamo-electric machine, and the other end from the last lamp or motor, or each of the end lamps or motors (as the case may be), to a well prepared earth, or large copper plate or copper coil securely embedded in damp earth, the said earth being a medium for completing the circuit. When the lighting is only on one side of the machine, then a small second wire is connected from the dynamo to the earth, as above described. When the number of lamps or motors (as the case may be) on either side of the dynamo-electric machine is unequal, resistance coils are employed to balance the resistance. (*Provisional only.*)

5006. "Regulating the production of electricity by dynamo-electric machines." F. WRIGHT and F. A. ORMISTON. Dated November 15. 2d. When an electric current produced by a dynamo-electric machine is applied to perform several operations, such as working several electro dynamic machines or supplying several electric lights, it is subject to variation when some of these are brought into or thrown out of operation, and consequently those that are left in circuit are subject to irregularity. The invention relates to means of preventing serious irregularities arising from this or from other causes by applying to the producing machine a regulating apparatus of the following description;—Between two rollers caused to revolve in opposite directions is mounted a third roller which in its middle position is clear from both, but which can be moved a little laterally so as to be pressed against the one or the other, and so to be driven by frictional contact in the one direction or the other. This lateral movement of the middle roller is effected by connecting its axis to the core of a solenoid having its coil in a branch from the circuit that is to be regulated. The axis of the middle roller has on it a screw thread working a worm wheel or nut to which is attached a rotating or sliding spring that bears against a surface presenting pieces of conducting metal interspaced with insulating material. These pieces of metal are connected with electrical resistances of various magnitudes that are by the contact of the spring brought into the circuit of the field magnets of the producing machine. The action of the apparatus is as follows:—If, owing to the throwing out of action or bringing into action of one or more of the machines or lamps that are connected to the main circuit, or owing to other causes, the current becomes varied, then the core of the solenoid is caused by the alteration of the attractive force to move so as to bring the middle roller into contact with one or other of the two oppositely revolving rollers.

The middle roller being thus caused to revolve, the screw thread upon its axis causes the spring to move over the surface above mentioned, which presents contacts for the resistances. A greater or less resistance is thus introduced into the circuit of the field magnets, and the production of electricity by the machine is thus decreased or increased as the case may be. By suitably proportioning a weight or spring arranged to counterpoise the attraction of the solenoid core, and employing suitably proportioned resistances, variations in the expenditure of electricity can by the use of the regulating apparatus be so far compensated by variations in its production, that the machines, lamps, or other objects in the circuit receive approximately uniform supplies of electricity. (*Provisional only.*)

5026. "Telephone receivers." F. H. W. HIGGINS. Dated November 16. 2d. Instead of the usual arrangement of an iron diaphragm set in motion by the intermittent electrical impulses transmitted through a coil attached to the end of a permanent magnet, the inventor employs a solenoid or hollow coil or coils attached to the diaphragm, which may be of non-magnetic metal or of non-metallic material. The end of a magnet fixed to the handle part of the telephone passes into, without touching, the hollow coil or solenoid. The action of the electrical impulses is thus more direct than when transmitted magnetically through the permanent magnet to an iron diaphragm, and the resulting sounds are of greater purity and volume. (*Provisional only.*)

5028. "Telephone receivers." R. THEILER and M. THEILER. Dated November 16. 6d. Has for its object improvements in telephone receivers. In all previous systems of telephone receivers in which an electro-magnet was used the sonorous vibrations received were due either to the motion of an iron diaphragm or armature placed close to the poles of the electro-magnet, or in a form of telephone, but little used to the longitudinal expansion and contraction of the magnet itself while under the influence of a vibratory current. The present invention consists in the construction of electro-magnetic telephone receivers in which the armature is entirely dispensed with, and the lateral vibration of the electro-magnet is made use of. For this purpose the electro-magnet may be made of the usual U-shape, and may consist either of soft iron or hardened steel permanently magnetised, wound with a suitable number of turns of insulated wire. This electro-magnet is fixed in such a manner that the vibration of either one or of both of its limbs is communicated to a diaphragm or diaphragms. The figure represents one of the telephone receivers pro-



vided with two diaphragms or sounding boards, D, D, connected to the two limbs or cores of the U-shaped electro-magnet, E, by the short tongues, c, c^1. These tongues are firmly inserted in the diaphragms and fixed to the magnet, as shown. The poles S, N, of the electro-magnet are brought very close together by being shaped as shown, and the middle part of the magnet is firmly screwed to the case, A, A, of the instrument. The ends of the helix surrounding the magnet cores may be attached as usual to two terminals, or soldered to a flexible conductor communicating with the other parts of the telephone apparatus. When a vibratory current is sent through the helix of the electro-magnet the extremities, N, S, are rapidly attracted and repelled, and this vibratory motion of the magnet cores being communicated to the diaphragms or sounding-boards, the latter are set in vibration of varying amplitude produced by a current of varying strength, as in all other telephones.

5071. "Telephonic transmitting apparatus." ERNEST DE PASS. (A communication from abroad by Léon de Locht-Labye, of Paris.) Dated November 19. 4d. Relates to improvements in telephonic transmitting apparatus, and especially in those know as pantelephones, and is characterised by the employment, in combination with batteries or voltaic currents, of a sound-receiving plate of unpolished wood, cork, or other suitable material, which plate, while offering a large surface, is of slight weight, and freely swings about one of its points of support, or preferably on the end of spring levers, said plate carrying a carbon contact piece, which bears against a stop or abutting piece of carbon or of metal, such as silver or platinum. The sound-receiving plate or pantelephone is by preference fixed at the ends of spring arms or rods, which have very great freedom of movement, allowing the plate to undergo extensive variations of position under the influence of very feeble sounds produced by the human voice, whether such sounds be emitted at some distance or by the ordinary speech under the conditions which are most convenient for a regular telephonic service. (*Provisional only.*)

CITY NOTES.

OLD BROAD STREET.

THE SOUTH AFRICAN BRUSH ELECTRIC LIGHT COMPANY (LIMITED).

ON Monday last an extraordinary general meeting of the above company was held in Cannon Street Hotel, Lieut.-Col. G. Coxon occupying the chair.

The Chairman said: Gentlemen, you have been made aware in the circular, which I think you will all have received, that this meeting is convened wholly for the purpose of complying with the instructions of the committee of the Stock Exchange with regard to the alteration of one of the articles of association. Mr. Seel will read the notice, and perhaps, gentlemen, as you will all have received the amended article, you will take it as read. If not, we will read the whole of it.

Thos. J. Seel, Esq., then read the notice convening the meeting; and the resolution, which was as follows, was taken as read:—

"That the articles of association be altered in manner following, that is to say, the following Article shall be substituted for Article 71, viz.:—

"'71.—The office of director shall be vacated: 1. If he becomes bankrupt, or liquidating debtor, or lunatic, or compound with his creditors. 2. If he ceases to hold the requisite share qualification. 3. If he absents himself from the meetings of the board, without leave of the board, for a period of three consecutive months at any time.'

"'Any director (whether an ordinary director or a managing director) who otherwise than as a member or director of an incorporated company, is concerned in or participates in the profits of any contract or transaction with the company, or is entitled to any interest in any property about to be purchased or taken on lease by the company, shall at or before the time when such contract, purchase, or transaction shall be entered into or agreed to on behalf of the company, disclose the nature and extent of his interest in any such intended contract, transaction, or property, and thereupon a memorandum to that effect shall be entered in the directors' minute book. In default of such disclosure being duly made when and as required (but not otherwise) a director shall be held to be a trustee for the company to the extent of any profit or emolument he may have or obtain under or by reason of any such contract or transaction, or by reason of any such purchase or lease, and if such director be the sole person interested in such contract or transaction, or in the property purchased, or taken on lease, the contract, or transaction, or purchase, or lease may be set aside at the option of the company. A director who is concerned in or participates in the profits of any such contract or transaction shall not vote in respect thereof, notwithstanding that his interest is merely that of a member or director of an incorporated company, or that he has duly declared his interest, and if he does so vote, his vote shall not be counted.'"

The Chairman stated that at a second extraordinary meeting to be subsequently convened, it would be necessary to confirm the resolution now arrived at, if it was carried.

Mr. J. Julius Cohen asked if Mr. Macdonald, of the firm of Blane, Macdonald and Company, was also a director of the company? He understood that a contract had been entered into with that company, and that company would, therefore, be in the position of acting on the Board of a company from whom they were deriving benefit.

The Chairman explained that Mr. Macdonald was not present, that Mr. Anderson, who was present, was a member of that firm, but that he had not joined the Board until after the contract was completed.

The chairman then proposed that the resolution be adopted.

Mr. J. S. Gordon seconded the motion.

The Chairman: Gentlemen, I have nothing to offer in the way of remarks upon this occasion. I shall have a meeting, I think, within fourteen days, a confirmatory meeting of that which we are holding now, and upon that occasion we will also summon our statutory meeting, which we are bound to hold within a period of four months of the formation of the company. At the same time I am prepared to give any information that any shareholders may wish to ask.

The resolution was then put to the meeting and carried unanimously.

Mr. Cohen asked whether their shares would have a quotation on the Stock Exchange before the next meeting?

The Chairman said that, of course, that could not be till after the confirmatory meeting.

Mr. M. P. Shorrock would like to ask how the contract stood between the company and the town of Kimberley. It had been rumoured that a satisfactory contract had been entered into, which had also been denied. He that morning had heard it confirmed once more. It would be satisfactory to know what was the position of affairs.

The Chairman replied that, on the 11th May last—the very day, or the day before the company was formed—Blane and Macdonald received a telegram from Mr. Donald Macdonald, their manager, as follows: "Have made a contract with Kimberley." It appears that there were some difficulties raised there. There was a good deal of opposition, and the matter was submitted to the ratepayers while the agitation was going on. It has been rumoured that money has been subscribed in Kimberley for the purpose of raising an opposition and of taking legal measures. A poll took place subsequently of the ratepayers on the question of lighting the town. The question of lighting was carried by a majority of 21. Then money was raised for the purpose of questioning the legality of the poll; but I may tell you that about ten days ago—that is, three weeks subsequently, a report was spread about that the matter was to be opposed—we received a telegram again from Mr. Macdonald asking us to wire out an authority for the

Kimberley agent to sign a contract in the name of the company with the Mayor. I believe the Mayor is the one party and the agent is the other, so that you may take it for granted that ten days ago a contract was entered into between the Mayor of Kimberley, representing the corporation of the town, and the South African Brush Company, and that we are at the present in the position of holding a contract for the lighting of Kimberley for one year. There can be no question about it. We have had no subsequent telegram or no information that there has been any hitch in the procedure. We have, upon the receipt of this, sent out in a ship two machines—one a 16-light machine—for Kimberley, we presume it will be for Kimberley, it was ordered specially for Kimberley; but there is one there now, so that will be two in the hands of our agent. There will thus be a smaller machine for the disposal of our manager in any way he may think proper, as we think it advisable he should have at hand for immediate use the plant and machinery for taking advantage of any opportunity that may suddenly open for extending our operations.

Mr. M. P. Shorrock asked whether, as a matter of fact, the electric light had been used for some time in Kimberley, and not only there but in other places—Cape Town, for instance? He knew it was not a question for this meeting to deal with, but it would be satisfactory to know whether the contracts had been entered into with the Kimberley Corporation. It would be somewhat advantageous and could not do any harm.

Mr. Atkinson: We have not got the contract over here yet.

Mr. Shorrock: Then your agent out there has *carte blanche* in the question?

Mr. Atkinson said that to a very great extent that was so. Some time ago the agent had submitted terms to the Kimberley Corporation, and these terms afterwards had been taken into consideration and submitted to a meeting. This meeting had been adjourned from time to time, but a final meeting, it appeared, took place on the 10th May, and at it the contract was accepted. But they knew nothing more. Whether to some extent the contract had been modified it was, of course, no use to speculate till they had got it over; but had it been modified, no doubt the telegram would have mentioned it.

In answer to a question from a shareholder,

Mr. Atkinson stated that Kimberley had been lighted weeks—he might say months—before the contract was accepted.

Mr. Cohen said that in the prospectus it was stated that the town was lighted already, and he thought that statement was rather misleading, since there was no contract then existing. It was simply an experimental lighting.

The Chairman said he hardly thought it was misleading. Arrangements had been made with the authorities at Kimberley to light the town, but a contract had not been signed. They knew that for a very long time before the town was lighted as an experiment, but it was only on the 10th that the contract was made. Of course they all knew the difference between the making of a contract and the signing of it. A contract was not completed until it was signed.

Mr. Shorrock said they might take it as a fact that the contract was signed and arrangements finally made. He had heard that the terms were very advantageous to this company. Perhaps it would not be out of place to let them know what they were.

Mr. Anderson said he thought it would be very much out of place. They would only invite competition. It would be a very serious matter if they had the good fortune to get a big profit; there would be no doubt that other companies would step in and interfere with their contract.

The Chairman said that before long they would be in a position to give very exhaustive information of their prospects, because they had asked Mr. Macdonald—in fact, the very day on which the Company was formed—to come home, and he was now on his way. Till he came they could not have the papers nor any particulars, nor could they state sufficiently clearly and conclusively at a meeting like that what their present position really was.

Mr. Shorrock said that that was quite satisfactory, and of course he would not at all press for further information.

No other questions being put, a vote of thanks to the Chairman was passed, on the motion of Mr. Lloyd, seconded by Mr. James Smart, and the proceedings terminated.

THE BRUSH MIDLAND ELECTRIC LIGHT AND POWER COMPANY (LIMITED).

AN extraordinary general meeting of this Company was held on the 16th inst., at the City Terminus Hotel, Mr. James Whitehead presiding, when the resolutions passed at the meeting on the 1st inst. were unanimously confirmed. They were for making certain alterations in the articles of association of the company to comply with the requirements of the Stock Exchange, previously to being granted a settlement and quotation. The statutory meeting of the company took place afterwards, and the chairman stated that it was held in compliance with the Act of Parliament, providing that a general meeting should be held within four months of the allotment of the shares. In the short time during which they had been established almost the whole of their time had been occupied in the organisation of the company. They had received several overtures as to granting concessions to subsidiary companies, which they would be quite willing to do, providing they could see their way to making a fair profit, and that the sub-companies would work to their own benefit and with results which would not prove a discredit to the parent company. They had granted no concessions yet. Some remarks had been made that the "Brush off-shoots" had paid too much for their concessions, but so far as this company was concerned he held that the remark did not apply. They had paid £43,750 (of which £18,000 was in shares) for their concession for fourteen counties. They were satisfied as to the validity of their patents, apart from which they had the guarantee of the Brush Company on the point. He had no resolution to submit. In answer to questions, he stated that the £43,750 which they had paid to the Brush Company, included everything—that company had to receive absolutely nothing whatever further from them, while this company would have the benefit of any other improvements which might be made in the Brush system. Although they had been in existence for so short a time, they had, he said, successfully lighted up the Boston Docks and the markets of Chester, and their system was in active operation in Northampton.

THE Directors of the South-Eastern (Brush) Electric Light and Power Company (Limited) state that the sum of £1 per share, payable, in accordance with the prospectus, on the 1st July next, will not be required on that date. Two months' notice will be given when it shall be deemed advisable to call up that amount.

THE Metropolitan (Brush) Electric Light and Power Company (Limited) have removed their offices to 110, Cannon Street. Major Wood writes to us that he has resigned his seat at the board of this company.

IT is reported that the directors of the Brush Light Company propose to call up the remaining £6 per share on the £4 shares, while with the other hand returning that amount to the holders.

A DISCUSSION is going on as to the treatment of the £4 and the £10 holders respectively, it being held, with some justice, that inasmuch as the distributable surplus proceeds from the sale of the company's concessions—its stock-in-trade—it cannot be treated as dividend. Nobody would have any good cause to complain if the remaining £6 were called up on the former shares, an equal return being then made on all. An injunction to prevent the proposed return is threatened.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. June 21.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	27½-28½	27½, 28, 27½, 28, 28, 28